



# LPGA BOULEVARD FROM U.S. 92 TO WILLIAMSON BOULEVARD PD&E STUDY

FPID: 448456-1-22-01

## INTERCHANGE MODIFICATION REPORT

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022, and executed by the Federal Highway Administration and FDOT.

May 18, 2023



# Interchange Modification Report (IMR)



## LPGA Blvd from U.S. 92 to Williamson Blvd PD&E Study

FPID 448456-1-22-01

### Florida Department of Transportation Determination of Safety, Operational and Engineering Acceptability

Acceptance of this document indicates successful completion of the review and determination of safety, operational and engineering acceptability of the Interchange Access Request. Approval of the access request is contingent upon compliance with applicable Federal requirements, specifically the National Environmental Policy Act (NEPA) or Department's Project Development and Environment (PD&E) Procedures. Completion of the NEPA/PD&E process is considered approval of the project location design concept described in the environmental document.

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STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION  
**TECHNICAL REPORT COVERSHEET**

650-050-38  
ENVIRONMENTAL  
MANAGEMENT  
08/22

INTERCHANGE MODIFICATION REPORT

Florida Department of Transportation

District Five

LPGA Boulevard Project Development and Environment (PD&E) Study

Limits of Project: From U.S. 92 to Williamson Boulevard

Volusia County, Florida

Financial Management Number: 448456-1-22-01

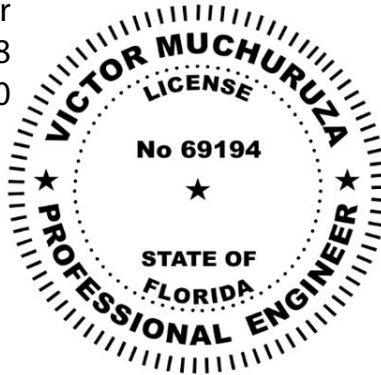
ETDM Number: 14332

Date: May 18, 2023

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SYSTEMS IMPLEMENTATION OFFICE

**QUALITY CONTROL CERTIFICATION FOR INTERCHANGE ACCESS REQUEST SUBMITTAL**

Submittal Date: 05/11/2023

FM Number: 448456-1-22-01

Project Title: LPGA Blvd Project Development and Environment (PD&E) Study, From U.S. 92 to Williamson Blvd

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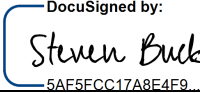
Status of Document: Draft

Quality Control (QC) Statement

This document has been prepared following FDOT Procedure Topic No. 525-030-160 (New or Modified Interchanges) and complies with the FHWA two policy requirements. Appropriate District level quality control reviews have been conducted and all comments and issues have been resolved to their satisfaction. A record of all comments and responses provided during QC review is available in the project file or Electronic Review Comments (ERC) system.

Requestor \_\_\_\_\_  
  
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 Jesse Blouin, AICP

Date: 05/18/2023 | 3:35 PM EDT

IRC \_\_\_\_\_  
  
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 Steven Buck, PE

Date: 05/19/2023 | 8:10 AM EDT

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

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## APPENDICES

**Appendix A** – Methodology Letter of Understanding (MLOU)

**Appendix B** – Phase 1 Analysis Memo

**Appendix C** – Conceptual Signing Plan

**Appendix D** – Project Traffic Forecasting Memorandum (PTFM)

**Appendix E** – Calibration Report

**Appendix F** – Traffic Count Data

**Appendix G** – Raw Data (OD Matrix, Signal Timing, Travel Speeds, Travel Time)

**Appendix H** – Safety Report

**Appendix I** – Existing Year 2021 Detailed Movement Results

**Appendix J** – Opening Year 2030 Detailed Movement Results

**Appendix K** – Design Year 2050 Detailed Movement Results

## Executive Summary

### E.1 Background

The Florida Department of Transportation (FDOT) is conducting Project Development and Environment (PD&E) Study of LPGA Boulevard from US 92 (SR 600) to Williamson Boulevard within the City of Daytona Beach in Volusia County. The proposed improvements involve widening of LPGA Boulevard which will include addition of bicycle and pedestrian facilities and modifications to the LPGA Boulevard/Interstate 95 (I-95) interchange. The existing LPGA Boulevard is a two-lane roadway from US 92 to Tomoka Farms Road (east of the Tomoka River), and a four-lane roadway from Tomoka Farms Road over I-95 to Williamson Boulevard. There are 13 intersections along the corridor including ramp terminals at the I-95 interchange, nine of which are signalized. LPGA Boulevard crosses the Tomoka River west of I-95. LPGA Boulevard is a county road maintained by Volusia County. In the existing condition, most of LPGA Boulevard does not have paved shoulders and sidewalks. I-95 is a six-lane, Strategic Intermodal System (SIS) facility and is a hurricane evacuation route. The I-95 interchange at LPGA Boulevard (Exit 265) is a partial cloverleaf interchange, or parclo interchange, with six on and off ramps.

### E.2 Purpose and Need

The purpose of this project is to accommodate existing and projected future travel demand, enhance safety, and improve operations for the LPGA Boulevard corridor and the I-95 interchange. The need for the project is based on existing and future transportation demand and existing high crash rates on LPGA Boulevard and in the interchange area. Improvements are necessary to address unacceptable levels of service (LOS) (below Volusia County intersection target of LOS E and FDOT interchange ramp terminal target of LOS D) and enhance the safety of travel conditions along LPGA Boulevard and at the I-95 interchange area. An Interchange Modification Report (IMR) is being prepared as part of the PD&E Study to document the evaluation of the proposed alternatives for the I-95 interchange.

### E.3 Methodology

The traffic methodology is consistent with the approved Methodology Letter of Understanding (MLOU) in **Appendix A**. The Area of Influence (AOI) includes LPGA Boulevard from Tournament Drive to Clyde Morris Boulevard, and I-95 from US 92 to SR 40. The analysis years are Existing 2021, Opening 2030, and Design 2050. Vissim 2021 was used for the analysis.

### E.4 Alternatives

Two alternatives were considered for analysis in the IMR. However, several configurations (such as expanded loop ramps, DDI, traditional diamond) were vetted in a Phase 1 analysis (included in **Appendix B**) to arrive at the following alternatives.

- No-Build Alternative – Maintain Existing Loop Ramps
- Build Alternative – Signalized Turbine

## E.5 Compliance with FHWA General Requirements

The FHWA Policy on Access to the Interstate System provides the requirements for the justification and documentation necessary to substantiate any proposed changes in access to the Interstate System. The policy is published under the Federal Register, Volume 74, Number 43743, dated May 22, 2017. The responses provided herein for each of the two policy statements demonstrate compliance with these requirements and justification for the proposed I-95 at LPGA Boulevard Interchange Modification Report (IMR) in support of the LPGA Boulevard PD&E Study in Volusia County, Florida.

### Policy

*It is in the national interest to preserve and enhance the Interstate System to meet the needs of the 21st Century by assuring that it provides the highest level of service in terms of safety and mobility. Full control of access along the interstate mainline and ramps, along with control of access on the crossroad at interchanges, is critical to providing such service. Therefore, FHWA's decision to approve new or revised access points to the Interstate System under Title 23, United States Code (U.S.C.), Section 111, must be supported by substantiated information justifying and documenting that decision. The FHWA's decision to approve a request is dependent on the proposal satisfying and documenting the following requirements.*

### Policy Point 1

*An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

## LPGA Boulevard from US 92 to Williamson Boulevard PD&amp;E Study

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**Response:**

## Operational Analysis Results

This IMR addresses the existing interchange at LPGA Boulevard that is planned to be modified. Detailed traffic operational analyses for the Existing Year 2021, Opening Year 2030, Design Year 2050 conditions were conducted to study the impacts of the Build Alternative within the area of influence.

The following operational analysis observations were made:

- **Networkwide** – The No-Build Alternative cannot accommodate future traffic growth, in either Design Year 2050 or Opening Year 2030, and results in gridlock conditions along LPGA Boulevard. The primary causes are the single-lane interchange exit ramps and the two-lane section of LPGA Boulevard west of I-95, which are considerably over capacity. Additionally, roadway segments and intersections do not have sufficient capacity to project future demand. In the Design Year 2050, the Build Alternative improves the total network delay by 77% in the AM peak hour and 78% in the PM peak hour compared to the No-Build Alternative. By Design Year 2050, latent demand increases when compared to the Opening Year 2030 due to congestion formed at the US 92/I-4 collector-distributor (CD) system and minor streets. The amount of latent demand is however significantly very low when compared to No-Build Condition. The results of operational analysis showed that the Build Alternative still provides significant benefit of reducing latent demand by 83% in the AM peak hour and 94% in the PM peak hour when compared to the No-Build Alternative. Additionally, the interchange improvements and roadway widening in the Build Alternative cause the networkwide average speeds to increase significantly from 11 mph to 37 mph in the AM peak hour and from 1 mph to 28 mph in the PM peak hour.
- **Freeway** – The microsimulation analysis results indicate that in both directions and peaks, the No-Build Design Year 2050 travel traffic flow is near standstill due to the ramp terminal intersections queuing back to the mainline and blocking through traffic. This also results in lower volume processed through I-95 since demand cannot reach the interchange area. Consequently, due to demand starvation (metering of demand upstream due to bottlenecks), the speeds in some segments (downstream of metered area) are higher and the throughput is low because of the queue discharge flow. Conversely, in the Build Alternative Design Year 2050, the bottlenecks (grid lock conditions) observed under No-Build Alternative are cleared. Therefore, the throughput (vehicle volumes) increases, and the travel speeds return to near free-flow speeds under Build conditions. This is due to the improved LPGA Boulevard interchange, which includes two-lane entrance and exit ramps. However, the I-95 southbound section, between LPGA Boulevard and the US 92/I-4 CD system, is expected to operate at capacity (LOS E) between 2045 and 2050 which will cause the speed to drop below 45 mph. Typically, when a segment is operating at near capacity, any slight increase of demand (caused by normal demand fluctuation) can trigger the breakdown. To minimize

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the recurrence of freeway breakdown in the US 92/I-4 CD system diverge area, ramp signals were added into the southbound on-ramp and the number of lanes at the entrance was reduced to one to further manage the demand from LPGA Boulevard into I-95 southbound lanes. This modification seems to extend the operational life of the diverge area to 2045. It is noted that the US 92/I-4 CD system diverge area is outside the limits of improvements for this PD&E. FDOT District 5 is aware of the operational issue at the US 92/I-4 CD system and is embarking on a strategic plan for I-95 to develop a long-term shared vision with the members of the communities and local stakeholders along the corridor. The I-95 strategic plan will identify short-term and long-term capacity, operational and safety improvements along the corridor. It is likely the recommendations from the strategic plan for US 92/I-4 CD system will be implemented by 2050. In the interim, a ramp signal at the southbound on-ramp has been evaluated. FDOT will evaluate additional Transportation Systems Management and Operations (TSMO) strategies in the interim to extend the operational life of I-95 south of LPGA Boulevard as part of the design phase for this project.

- **Ramp Terminals** – The LOS target for ramp terminals is LOS D. Intersection LOS F is expected in the No-Build by 2030, and delays will significantly increase by the Design Year 2050. Conversely, all ramp terminal intersections under Build Alternative conditions are expected to operate at LOS C or better in the Design Year 2050.
- **Arterial Intersections** – The LOS target for arterial intersections is LOS E. The No-Build Alternative is expected to operate at LOS F in the Opening Year 2030 and Design Year 2050 with excessive intersection delays and long queues. Proposed improvements in the Build Alternative are expected to significantly reduce intersection delays and queues at all intersections. It is noted that in the Design Year 2050 Build Alternative, LOS F is expected at Tymber Creek Road, Tomoka Farms Road, Technology Boulevard, and Concierge Boulevard due to capacity limitations of minor street improvements (which are outside of the scope of this PD&E). Both the City of Daytona Beach and Volusia County are aware of the need for network expansion and are looking at several roadway improvements in the local network in response to the current and projected growth in the LPGA Boulevard subarea. However, these improvements are not currently programmed in the local government comprehensive plans. In recognizing the need for future capacity, LPGA Boulevard and I-95 ramps have been sized with number of lanes enough to serve the latent demand from adjacent crossing streets. It is noted that Tomoka Farms Road, and Technology Boulevard intersections are located adjacent to the I-95 ramp terminals. Although the minor street delay drives up overall intersection delay, it is not expected to adversely impact I-95 ramp terminal operations.
- **Overall** – The proposed Build Alternative provides a benefit to the network and does not adversely impact operations.

## LPGA Boulevard from US 92 to Williamson Boulevard PD&amp;E Study

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### Safety Analysis Results

A safety analysis was conducted for the future conditions on LPGA Boulevard from Tournament Drive to Clyde Morris Boulevard, including the I-95 interchange area. The following findings were obtained from the safety analysis:

- **I-95 Interchange** – Overall crashes per year, including fatalities and injuries, are expected to decrease by approximately 29% in the Build Alternative over the analysis period (from 2030 through 2050). In the Build Alternative, the forecasted total number of crashes for the analysis period show a substantial decrease for freeway segments and slight decrease for ramp segments. The decrease in freeway segment crashes for the Build alternative could be attributed to the reduction of ramp entrances and exits along the freeway segments in the Build condition. It is noted that although the total number of crashes for ramp segments is expected to decrease, the property-damage-only crashes are expected to slightly increase; fatalities and injuries are expected to slightly decrease. The interchange ramp segments are longer in the Build Alternative and the additional ramp lengths could be contributing to the additional predicted crashes in the Build Alternative for this facility component.
- **LPGA Boulevard Arterial** – In Design Year 2050, the No-Build Alternative would result in a total number of 182.7 crashes per year and the Build Alternative forecasts 113.5 crashes per year, which is a reduction of 69.2 future crashes per year (or 38%) for the arterial segments and intersections. Reduction in expected crashes is the result of proposed improvements at the intersections and widening of the LPGA Boulevard corridor.
- **Crash Cost Comparison** – The Build Alternative is forecasted to incur a lesser predicted crash cost by approximately \$1.6 billion than the No-Build Alternative for the 2030 to 2050 analysis period.

### Conceptual Signing Plan

Conceptual signing plans were developed per the Manual on Uniform Traffic Control Devices (MUTCD) guidelines and are included in **Appendix C**.

### Policy Point 2

*The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with*

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*a comparison of the operational and safety analyses to the partial interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.*

**Response:**

The existing I-95 interchange provides full access to LPGA Boulevard, which is a public facility, and the proposed IMR concept will maintain and provide interchange access serving all traffic movements to and from I-95. The proposed improvements under the IMR concept are designed to meet current standards for federal-aid projects on the interstate system and conform to the American Association of State Highway and Transportation Officials (AASHTO) and the FDOT Design Manual (FDM).

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 1.0 Introduction

This Interchange Modification Report (IMR) documents the request for improvements to LPGA Boulevard/Interstate - 95 (I-95) interchange in the City of Daytona Beach, Volusia County. This IMR has been developed in accordance with relevant Florida Department of Transportation (FDOT) procedures and processes contained in the latest *2019 FDOT Project Traffic Forecasting Handbook*, *2021 FDOT Traffic Analysis Handbook*, *2022 FDOT Interchange Access Request User's Guide* and *2022 FDOT Design Manual*.

#### 1.1 Project Description

FDOT is conducting a Project Development and Environment (PD&E) Study of LPGA Boulevard from US 92 (International Speedway Boulevard) to Williamson Boulevard within the City of Daytona Beach in Volusia County (approximately 6.6 miles). The proposed improvements involve widening the LPGA Boulevard which will include the addition of bicycle and pedestrian facilities and modifications to the LPGA Boulevard/I-95 interchange.

A project location map is provided in **Figure 1**. Existing LPGA Boulevard is a two-lane roadway from US 92 to Tomoka Farms Road (east of the Tomoka River), a four-lane roadway from Tomoka Farms Road to the I-95 Southbound Ramps, and a six-lane roadway from the I-95 Southbound Ramps over I-95 to Williamson Boulevard. There are 14 intersections along the corridor including ramp terminals at the I-95 interchange, nine of which are signalized.

LPGA Boulevard is a county road maintained by Volusia County, except between Tomoka Farms Road and Technology Boulevard/Outlet Boulevard where FDOT maintains the limited access right-of-way to the I-95 interchange. Most of LPGA Boulevard does not have paved shoulders and sidewalks, and there are only limited areas of sidewalks between Tymber Creek Road and Williamson Boulevard.

I-95 is a six-lane, Strategic Intermodal System (SIS) facility and is a hurricane evacuation route. The I-95 interchange at LPGA Boulevard (Exit 265) is a partial cloverleaf interchange, or parclo interchange, with six on and off ramps. This interchange is located approximately 3.5 miles north of the I-95 and US 92 interchange and approximately 2.7 miles south of the I-95 and SR 40 interchange.

#### 1.2 Purpose and Need

The purpose of this project is to accommodate existing and projected future travel demand, enhance safety, and improve operations for the LPGA Boulevard corridor and the I-95 interchange.

The need for the project is based on existing and future transportation demand and safety along the LPGA Boulevard corridor and at the interchange area. Improvements are necessary to address unacceptable levels of service (LOS) (below target LOS D and LOS E) and enhance the safety of travel conditions along LPGA Boulevard and at the I-95 interchange area.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study Interchange Modification Report



Figure 1. Project Location Map

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 1.2.1 Transportation Demand

LPGA Boulevard from US 92 to Williamson Boulevard is currently operating near capacity. A review of existing (2021) traffic volumes in the project area showed an Annual Average Daily Traffic (AADT) of 12,000 vehicles per day for LPGA Boulevard from US 92 to Tomoka Farms Road and an AADT of up to 44,000 vehicles per day from Tomoka Farms Road through the I-95 interchange to Williamson Boulevard. Large, approved developments and active construction projects (such as LPGA Preserve, Indian Road Warehouse, and Tomoka Village), in combination with additional planned growth in the vicinity of LPGA Boulevard, are expected to increase traffic to levels that would exceed maximum service volumes for two-lane and six-lane, non-state, signalized roadways per the 2020 FDOT Quality/Level of Service (QLOS) Handbook. Future (2050) travel demands along LPGA Boulevard are expected to double or triple in some locations. The AADT between US 92 and Tymber Creek Road is expected to reach 36,000 vehicles per day. Heavy volumes are expected east of the I-95 interchange where AADT will reach 78,000 vehicles per day in 2050. These volumes will significantly exceed the existing roadway capacity and cause LPGA Boulevard to operate at LOS F.

The target LOS for I-95 and LPGA Boulevard is LOS D per FDOT and LOS E per Volusia County. The I-95 freeway segment approaching LPGA Boulevard currently functions at LOS D or better. However, queuing has been observed on the I-95 northbound and southbound off-ramps and on westbound LPGA Boulevard west of I-95, indicating capacity deficiencies. Based on anticipated growth, the quality of traffic flow on I-95 and LPGA Boulevard in the study area is expected to decline in future years. Without improvements to the LPGA Boulevard corridor, the intersections on LPGA Boulevard as well as the I-95 off-ramps are anticipated to operate over capacity in the future resulting in longer travel times to reach workplaces, schools, and businesses.

### 1.2.2 Safety

A review of crash data reported in the study area for the five-year period from January 1, 2015 to December 31, 2019 indicated there were 1,354 crashes, an average of 270 crashes per year. The most predominant crash type reported for the overall study area is rear-end crashes (37%). There were 11 reported fatal crashes (8 reported in the IMR area of influence), 414 injury crashes and 929 property-damage-only crashes reported for the overall study area.

The highest numbers of crashes correspond to the locations with deficient LOS. These include the I-95 northbound off-ramp to LPGA Boulevard with crashes during the intersection's right turn on red condition; the I-95 southbound loop on-ramp from LPGA Boulevard westbound, and the eastbound approach of LPGA Boulevard to Williamson Boulevard. There are also high numbers of crashes at the intersections and uncontrolled access points along LPGA Boulevard. Most of LPGA Boulevard lacks pedestrian and bicycle facilities, which creates unsafe conditions for nonmotorized users. Between 2015 and 2019 six pedestrian/bicycle crashes were reported within the PD&E study area.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study Interchange Modification Report

Without improvements to the LPGA Boulevard corridor and at the I-95 interchange, the number of crashes is expected to continue to rise as future traffic volumes increase substantially, compromising the safety for both vehicular and nonmotorized users.

## 2.0 Methodology

The analysis methodology follows the *2021 FDOT Traffic Analysis Handbook* and the Methodology Letter of Understanding (MLOU), found in **Appendix A**.

### 2.1 Area of Influence

The Area of Influence (AOI), shown in **Figure 2**, includes the below listed roadway segments and intersections. Since the MLOU was approved, there have been modifications to the AOI. The AOI was extended to include the Tournament Drive intersection to the west. Tournament Drive helps capture the signal progression to and from Tymber Creek Road, which is expected to be a very high-volume intersection in the future, and is intended to capture any future bottlenecks. To facilitate acceptable operational performance at Tymber Creek Road, there was also potential for Tournament Drive to be included in an alternative intersection solution in the future.

Since development and approval of the MLOU, changes have occurred at the Priest Branch Road and Concierge Boulevard intersections. Priest Branch Road (Unsignalized Intersection) was removed from the AOI because this intersection has recently been closed and the roadway realigned to form a new north leg of the Champions Road intersection. Concierge Boulevard was added into the AOI after the county upgraded the driveway to a full unsignalized intersection.

#### Roadways

- LPGA Boulevard: From Tournament Drive to Clyde Morris Boulevard
- I-95: From the north gore point of the US 92 interchange to the south gore point of the SR 40 interchange, including all six ramps at the LPGA Boulevard interchange

#### Intersections/ramp terminals

- LPGA Boulevard at Tournament Drive (Signalized)
- LPGA Boulevard at Tymber Creek Road (Signalized)
- LPGA Boulevard at Champions Drive (Signalized)
- LPGA Boulevard at Tomoka Farms Road (Signalized)
- LPGA Boulevard at I-95 Southbound Ramps (Signalized)
- LPGA Boulevard at I-95 Northbound Ramps (Signalized)
- LPGA Boulevard at Technology Boulevard/Outlet Boulevard (Signalized)
- LPGA Boulevard at Williamson Boulevard (Signalized)
- LPGA Boulevard at Concierge Boulevard (Unsignalized)
- LPGA Boulevard at Clyde Morris Boulevard (Signalized)

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study Interchange Modification Report

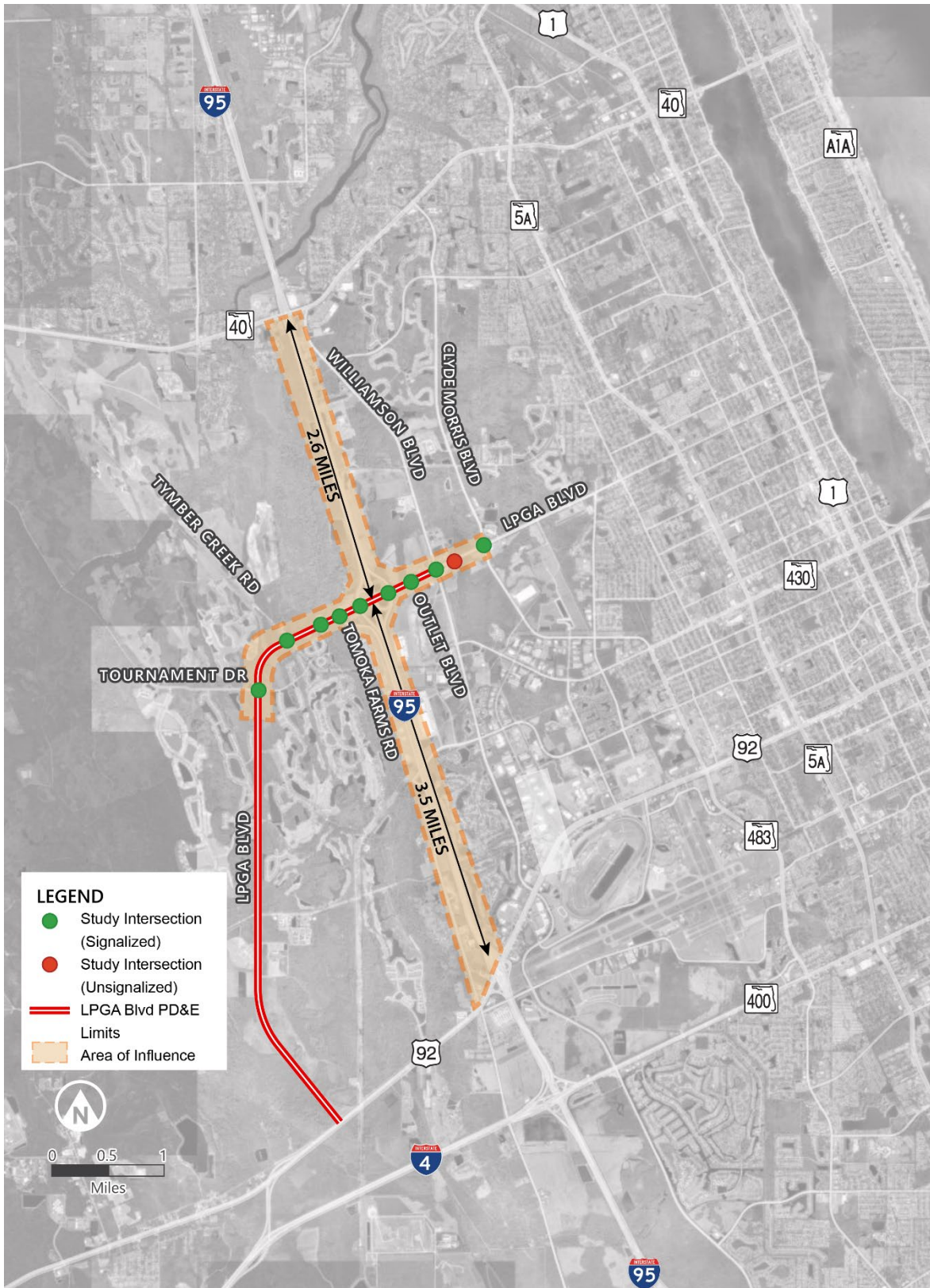


Figure 2. Area of Influence

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 2.2 Analysis Years

The years used for travel demand forecasting were:

- Base Year 2015
- Horizon Year 2045

The years used for the traffic operational analysis were:

- Existing Year 2021
- Opening Year 2030
- Design Year 2050

### 2.3 Analysis Periods

The study area was analyzed for a three-hour peak period in the AM and the PM. The total model time was four hours to include 30-minute shoulder periods.

### 2.4 Analysis Tools

The microsimulation software Vissim version 2021.00-12 was used for the operational analysis. Synchro was used for signal timing optimization.

### 2.5 Considered Alternatives

Consistent with the approved MLOU, two alternatives were considered in this IMR:

- No-Build Alternative
- Build Alternative

### 2.6 Analysis Approach

#### 2.6.1 Travel Demand Forecasting

The Central Florida Regional Planning Model version 7.0 (CFRPM 7) was used to complete the modeling. The model base year is 2015 and the model design year is 2045. The methods and assumptions are consistent with the MLOU. Any deviations are described and validated in the Project Traffic Forecast Memorandum (PTFM), located in **Appendix D**. All methods and assumptions used in the future traffic forecast are in accordance with FDOT's established policies and procedures, including those detailed in the *2019 Project Traffic Forecasting Handbook*, and the *Florida Standard Urban Transportation Modeling System (FSUTMS) User's Manual*. The PTFM documents the travel demand modeling effort and the existing and future traffic forecasts.

#### 2.6.2 Traffic Operational Analysis

The Vissim analysis was conducted using 15-minute flow rates to represent traffic fluctuations during simulated peak hours. The Vissim simulation time was 4 hours, which included a 30-minute shoulder period before and after the peak period.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

Vissim models were developed and calibrated to the Existing Year 2021. Calibration was based on traffic volume, I-95 travel speeds, LPGA Boulevard travel times, and visual audits. The calibration report is in **Appendix E**. Calibration parameters were carried forward to the future Opening Year 2030 and Design Year 2050 analyses.

The Measures of Effectiveness (MOEs) assessed from the Vissim models include:

- Network-wide
  - Total delay, average delay, total travel time, average speed, latent demand
- Freeway Segments
  - Volume, speed, density, estimated LOS
- Arterials Segments
  - Travel time and speed on LPGA Boulevard
- Intersection-level
  - Intersection delay, movement delay, estimated intersection LOS, average and maximum queue lengths

Link evaluation output was used for reporting freeway density and estimated LOS. An estimated LOS was based on the *Highway Capacity Manual (HCM) 6<sup>th</sup> Edition* freeway segment density LOS thresholds (basic freeway segments from HCM Exhibit 12-15 and merge/diverge freeway segments from HCM Exhibit 14-3).

Node evaluation output was used for reporting intersection delay, estimated LOS, and queue lengths. An estimated LOS was based on the HCM signalized control delay thresholds (HCM Exhibit 19-8).

### 2.6.3 Safety Analysis

A quantitative safety analysis was performed utilizing crash data from January 1, 2015 through December 31, 2019. Crash data was reviewed to determine any crash trends or patterns, crash contributing causes, and locations with crash rates higher than the statewide average.

The safety analysis also included an evaluation of the safety performance of the proposed improvements and comparing them with the No Build Alternative. A quantitative safety analysis was performed consistent with the *2022 FDOT Interchange Access Request User's Guide Safety Analysis Guidance*. Methodology from the *2010 Highway Safety Manual (HSM)* Chapters 12 (Urban and Suburban Arterials), 18 (Freeways), and 19 (Ramps), HSM Spreadsheets (Urban and Suburban Arterials Spreadsheet v3.1), and the Interchange Safety Tool Enhanced (ISATe) were used.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 3.0 Existing Conditions

This section summarizes the conditions for the Existing Year 2021.

#### 3.1 Data Collection

Traffic data, origin-destination data, microsimulation data, and crash data were collected to evaluate the existing conditions. Field observations were made between December 2021 and February 2022.

##### 3.1.1 Traffic Data

Traffic counts were collected in the field during November and December 2021. The data collection map is shown in **Figure 3**. The 8-hour manual turning movement counts, including pedestrian and bicycle counts, were collected from 6:00 AM to 10:00 AM and from 3:00 PM to 7:00 PM. Vehicle classification counts were collected for either 48 hours or 72 hours. Raw traffic counts are included in **Appendix F**.

The lane configurations were obtained from November 2021 FDOT aerials. **Figure 4** shows the Existing Year 2021 lane configurations.

The measured traffic factors from the field-collected counts are in **Table 1**. It is noted that the study area has unique peaking characteristics and travel patterns given the existing commercial area east of I-95, and the developing residential area west of I-95. The peaking characteristics and travel patterns cause a large fluctuation and deviation from the standard K and D values for similar area types. This necessitated the use of measured traffic factors shown in Table 1. More detailed traffic factors for each segment are in the PTFM in **Appendix D**.

*Table 1. Measured Traffic Factors – Existing Year 2021*

Road	Limits	K	D	T24
<b>I-95</b>	South of LPGA Blvd	7.0%	54.2%	17.0%
	North of LPGA Blvd	6.9%	53.6%	18.0%
<b>Ramps</b>	Southbound Off-Ramp	8.6%	100%	6.0%
	Southbound On-Ramp (WB to SB)	7.6%	100%	7.0%
	Southbound On-Ramp (EB to SB)	9.1%	100%	4.8%
	Northbound On-Ramp (EB to NB)	9.3%	100%	8.4%
	Northbound On-Ramp (WB to NB)	8.1%	100%	5.5%
	Northbound Off-Ramp	7.6%	100%	6.3%
<b>LPGA Blvd</b>	Tournament Dr to I-95 SB Ramps	7.9% - 8.6%	52.5% - 70.4%	3.9% - 5.7%
	I-95 SB Ramps to Williamson Blvd	7.6% - 7.9%	55.6% - 61.0%	2.4% - 3.0%

# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

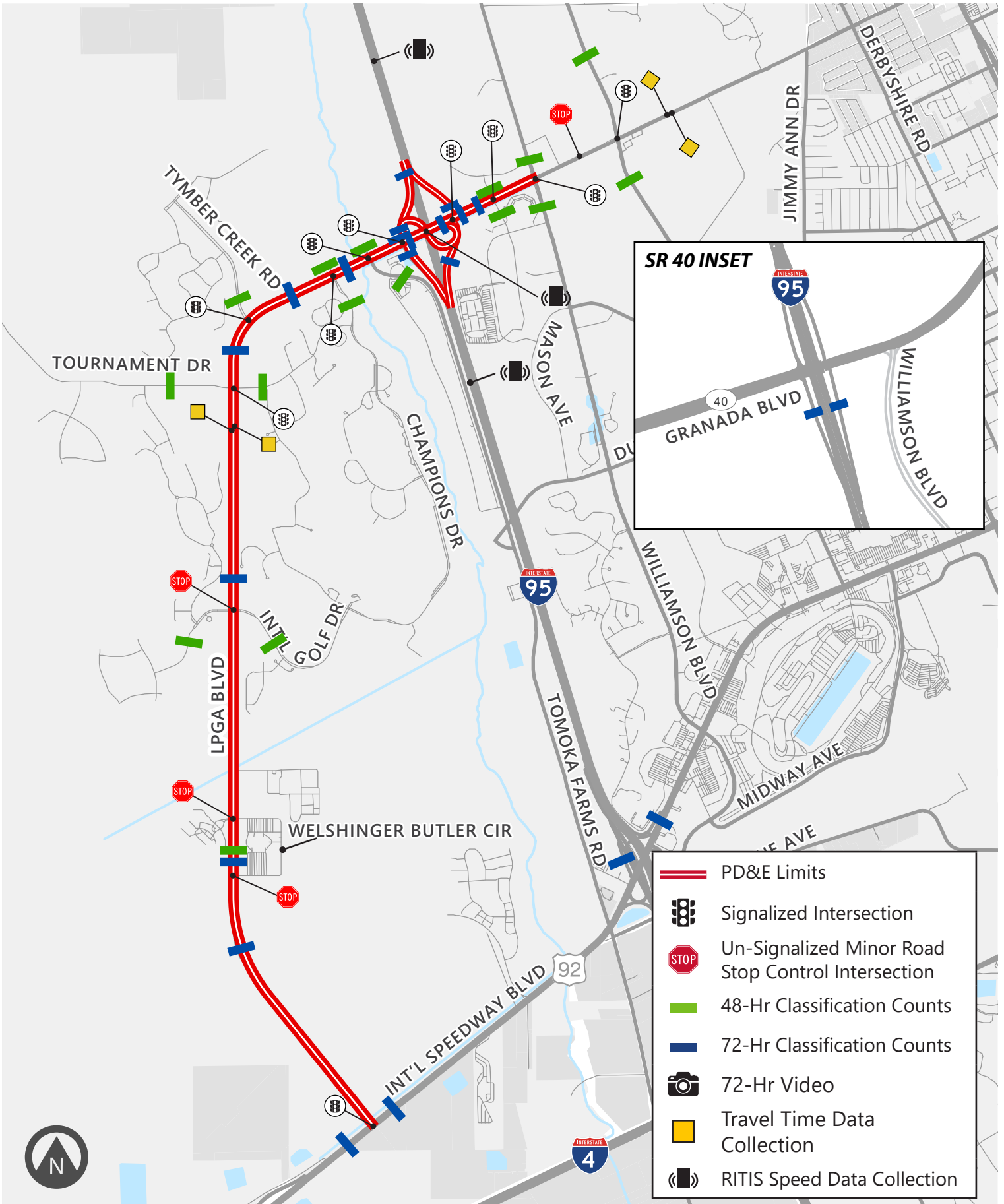
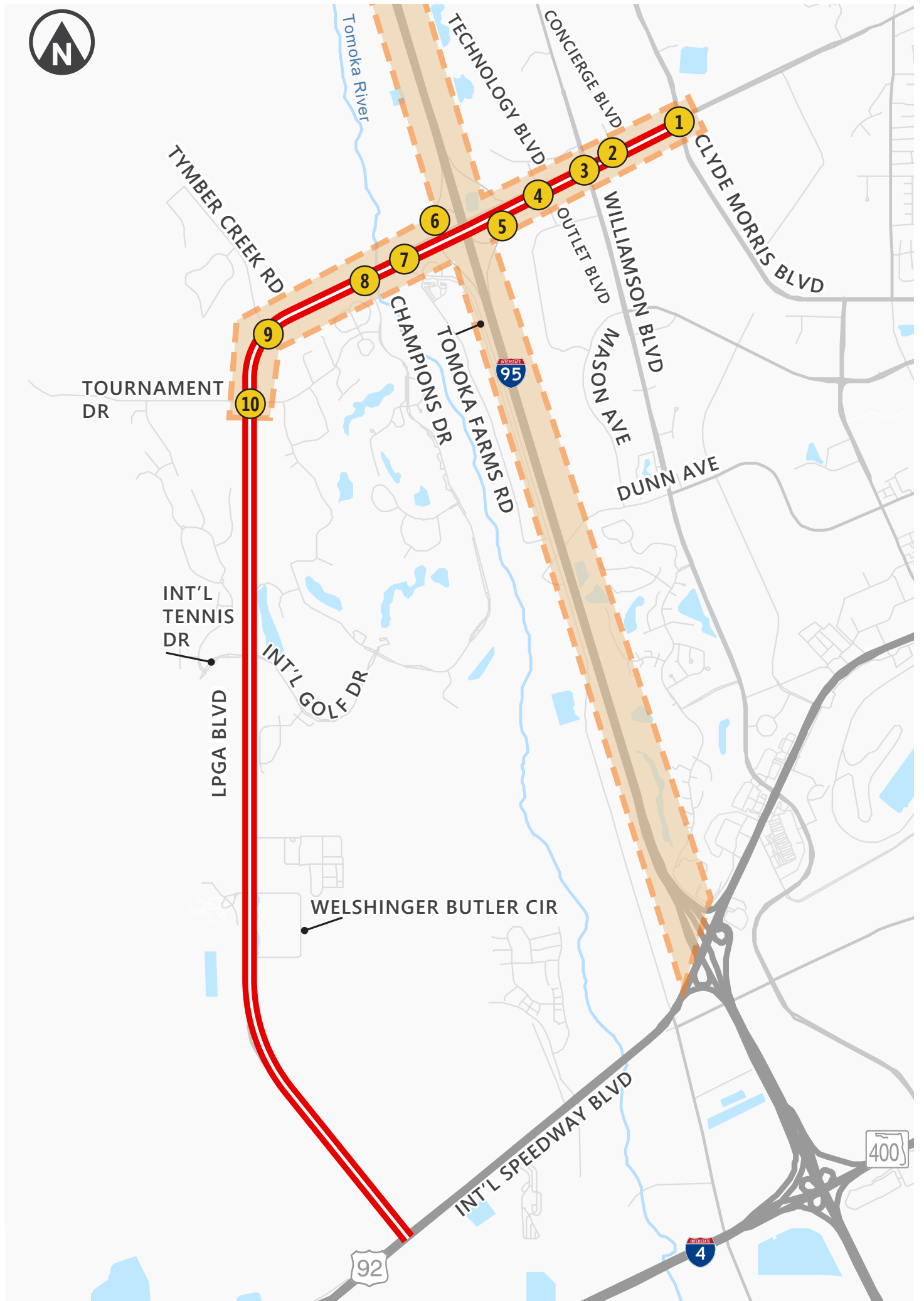
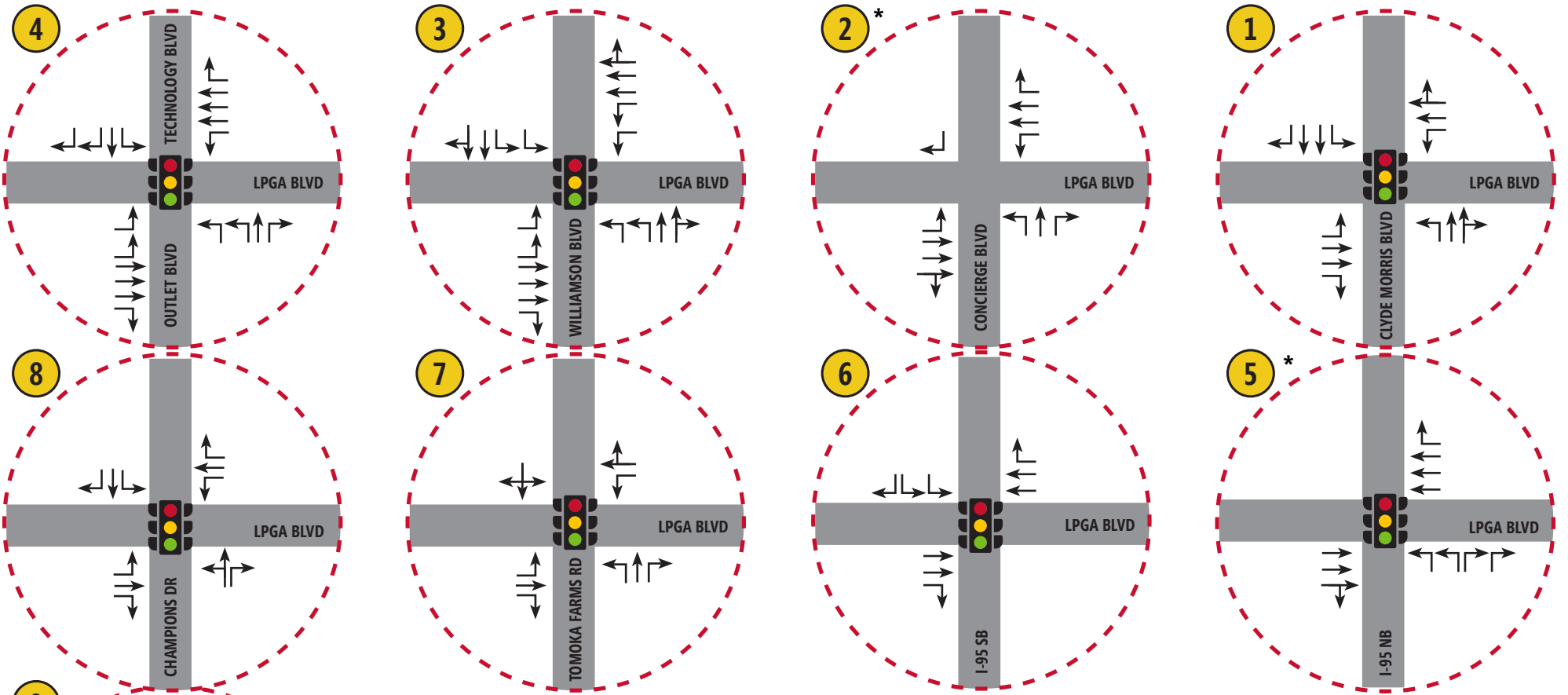


Figure 3. Data Collection Map



### LEGEND

- X Study Intersections
- PD&E Limits
- IMR Area of Influence

\*Note: Configuration differs from PTFM. Configuration was updated between PTFM development and operational analysis.

Figure 4. Existing Lane Configurations

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 3.1.2 Origin Destination Data

StreetLight Origin-Destination (OD) Data was used to understand how traffic was using LPGA Boulevard. While the primary OD movement is along the I-95 mainline, there are major attractors and generators that affect driving patterns to and from the I-95 ramps. The OD data is also useful for estimating lane configurations and lane continuity required for future conditions. The OD matrix is shown in **Appendix G**. It was applied in the existing condition microsimulation model.

Major attractors and generators adjacent to I-95 include:

- Auto Mall on Tomoka Farms Road
- Buc-ee's on Technology Boulevard
- Tanger Outlets and Restaurants on Outlet Boulevard

### 3.1.3 Microsimulation Data

Signal timing data, I-95 travel speed data, LPGA Boulevard travel time data, and I-95 queue length observations were collected to support the existing conditions calibration. The sources are in **Table 2**. The raw data is in **Appendix E**.

The I-95 speed data was used to develop speed distribution profiles, which account for area-specific driving characteristics. For instance, the speed limit on I-95 is 65 mph but the measured 85th percentile speed was 74 mph (free-flow speed).

*Table 2. Microsimulation Field Data*

Data	Source	Use
Signal Timing	Volusia County and Field Videos	Input and Calibration
Travel Speeds	RITIS for I-95, Field Data Collection for LPGA Blvd, Google Typical Traffic	Input and Calibration
Travel Times	Field Data Collection, Google Typical Traffic	Calibration
I-95 Exit Ramp Queue Lengths	Field Observations, FL511 Traffic Cameras	Calibration Visual Audits

### 3.1.4 Crash Data

A five-year crash data analysis was completed for crashes reported between January 1, 2015 and December 31, 2019, in accordance with Part 2, Chapter 2 of the *Florida Department of Transportation (FDOT) PD&E Manual*. The records of crash data were retrieved in December 2021. Online crash data for the state-maintained roadways was extracted from the FDOT Crash Analysis Reporting (CAR) System. This section summarizes the analysis. The safety report is in **Appendix H**.

#### I-95 at LPGA Boulevard Interchange Ramps

The five-year analysis for the I-95 interchange ramps at LPGA Boulevard found 68 total reported crashes. There were no fatal crashes reported along the six ramps at the interchange.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

The I-95 southbound off-ramp had the greatest number of reported crashes with 34 total reported crashes and 12 injury crashes. The I-95 northbound off-ramp had the second highest number of reported crashes with 22 total reported crashes and 9 injury crashes. The ramps with the least number of reported crashes were the I-95 southbound on-ramp from eastbound LPGA Boulevard and I-95 northbound on-ramp from westbound LPGA Boulevard with two reported crashes each. Overall, 19% of the reported crashes that occurred at the interchange ramps were wet weather crashes and 31% were reported to occur in dark conditions. Both of these values are higher than the 2019 statewide averages of 14% for wet weather crashes and 24% for dark crashes, according to 2019 Florida Highway Safety and Motor Vehicles (FLHSMV) statistics.

### LPGA Boulevard Arterial

The five-year crash data analysis found 592 total reported crashes on LPGA Boulevard within the PD&E study limits. The most predominant crash type recorded for this roadway segment was rear-end crashes (51%) followed by left turn and other/unknown crashes (11%). As noted earlier, the PD&E limits extend outside of the IMR AOI. Intersection crashes and segment crashes are summed together for the PD&E limits to obtain a total number of arterial crashes. There were 385 crashes reported at intersections within the IMR AOI and 207 crashes that were reported to occur on LPGA Blvd segments and intersections within the PD&E study limits. The crash histories at each of the study intersections within the AOI are summarized below. There was one pedestrian crash at Tournament Drive and one at Williamson Boulevard. The data shows that property-damage-only (PDO) crashes were more common at every intersection except Outlet Boulevard, where injury crashes occurred more frequently.

Of 592 total reported crashes, 385 crashes occurred at the intersections as follows:

- Tournament Drive – 50 total crashes (13 injury, 37 PDO)
- Tymber Creek Road – 3 total crashes (2 injury, 1 PDO)
- Champions Drive – 10 total crashes (3 injury, 7 PDO)
- Tomoka Farms Road – 49 total crashes (14 injury, 35 PDO)
- Outlet Boulevard – 36 total crashes (28 injury, 8 PDO)
- Williamson Boulevard – 139 total crashes (1 fatal, 26 injury, 112 PDO)
- Clyde Morris Boulevard – 98 total crashes (2 fatal, 33 injury, 63 PDO)

Within the AOI limits along LPGA Boulevard, there were three fatal crashes which are summarized as follows:

1. 2017 – Vehicle one was traveling westbound on LPGA Boulevard toward the intersection of Clyde Morris Boulevard while vehicle two went to make a left-turn. Vehicle one ran the red light crashing into vehicle two and rolling on top of vehicle three.
2. 2019 – Vehicle one was traveling north on Williamson Boulevard and vehicle two was traveling west on LPGA Boulevard. Vehicle one failed to stop for the traffic control device resulting in a crash.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

3. 2019 – Vehicle one was traveling eastbound on LPGA Boulevard and made a left-turn onto Clyde Morris Boulevard in front of vehicle two causing a crash. Vehicle two was traveling westbound on LPGA Boulevard.

Within the PD&E limits along LPGA Boulevard but outside the AOI limits, there were three fatal crashes which are summarized as follows:

1. 2015 - Three vehicles were traveling north on LPGA Boulevard (1 mile north of US 92) where there was a flag man for Volusia County controlling in the roadway who motioned for vehicle three to stop. Vehicle three stopped and vehicle two stopped behind but vehicle one struck vehicle two in the rear forcing vehicle two into the rear of vehicle three. Vehicle two ran off the road to the right and vehicle three ran off the road to the left.
2. 2017 - Vehicle one was traveling east on US 92 and turned left in front of vehicle two traveling west on US 92 to go north on LPGA Boulevard. Vehicle two struck the passenger side of vehicle one. Both drivers of the vehicles were transported to hospitals and the passenger of vehicle one was pronounced dead at the scene.
3. 2019 - Vehicle one was driving southbound on LPGA toward US 92 with excessive speed failing to negotiate a curve in the roadway, crashing into a sign and being ejected from the car landing in a retention pond near Welshinger-Butler Circle.

### I-95 Mainline

The five-year crash data analysis found 694 total reported crashes for the roadway segment of I-95 mainline within the study limits. Of the 694 reported crashes on the I-95 mainline, 29% were reported to occur in wet weather conditions and 32% of the crashes were reported to occur in dark conditions. Both values are higher than the 2019 statewide averages of 14% for wet weather crashes and 24% for dark crashes, according to FLHSMV statistics. The most predominant crash type recorded for I-95 was off-road crashes (27%) with rear-end crashes (24%) as the second most predominant crash type for the reported period. The predominant cause of reported crashes is operating a motor vehicle in a careless or negligent manner (24%), with failed to keep proper lane (23%) as the second most predominant cause of crashes.

There were five reported fatal crashes, 208 injury crashes, and 481 PDO crashes reported on I-95 mainline for the five-year analysis period. The five reported fatal crashes are summarized as follows:

1. 2015 – Driver one was driving a motorcycle and made an evasive lane change from the outside lane to the middle lane when the vehicle was overturned and threw driver one to the inside lane, resulting in the fatality of driver one.
2. 2016 – Vehicle one was traveling south on I-95 in the outside lane when it fatally struck a pedestrian walking north along the outside I-95 lane. The police report listed no contributing action from driver one of vehicle one as a cause of crash, but the pedestrian was reported to have a positive drug test.
3. 2016 – Vehicle one lost control for unknown reasons making the vehicle spin out of control across the roadway before crashing into the tree line and overturning.
4. 2018 – Vehicle one was traveling at a high-speed southbound on I-95 in the center lane when vehicle two entered the southbound center lane due to a lane merge. Vehicle one

failed to slow in time and collided with vehicle two. Driver of vehicle one was pronounced deceased on the scene.

- 2018 – Vehicle one experienced a front right tire blowout in the middle lane traveling south on I-95, causing vehicle one to leave the travel lane and enter vehicle two's travel lane, the outside lane, causing left rear of vehicle one strike the front of vehicle two. After the collision, vehicle one rolled onto the roof and vehicle two entered the median, struck the guardrail causing vehicle two to become airborne into the northbound lanes on I-95 rolling onto its left side. Passenger of vehicle two was pronounced deceased two days after the crash was reported.

## 3.2 Existing Traffic Operational Analysis

Traffic operational analyses were conducted using Vissim version 2021.00-12, a widely used, behavior-based multi-purpose traffic microsimulation program. The measures of effectiveness include network-wide, freeway-level, and intersection-level. The existing lane configurations are shown in **Figure 4**. Global peak hours for the study area were based on traffic counts from field collected data as follows:

- AM Peak – 7:30 AM to 8:30 AM
- PM Peak – 4:45 PM to 5:45 PM

### 3.2.1 Existing Traffic

AADT and Directional Design Hour Volumes (DDHV) were developed as part of the PTFM. This section summarizes the approach. The full PTFM is in **Appendix D**. The Existing Year 2021 AADTs and turning movement volumes (TMVs) are shown in **Figure 5** and **Figure 6**.

### 3.2.2 Vissim Model Development and Calibration

Vissim models were developed and calibrated to 2021 Existing Conditions, following the *2021 FDOT Traffic Analysis Handbook* and the Methodology Letter of Understanding (MLOU). Calibration targets used were speed, volume, and travel times. The calibration report is in **Appendix E**.

The Vissim simulation time was 4 hours, which included a 30-minute shoulder period before and after the peak period. The peak hour was the second hour of the simulation, not including the 30-minute shoulder period. The shoulder periods allow congestion to build prior to the peak period and dissipate after the peak period.

Vissim vehicle inputs were coded in 15-minute intervals to represent traffic fluctuations during each hour. For future years, the same 15-minute flow rate is applied as a percentage of the peak hour. Visum's TFlowFuzzy matrix estimation tool was used to generate OD matrices, based on the StreetLight OD data.

# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study



## Interchange Modification Report

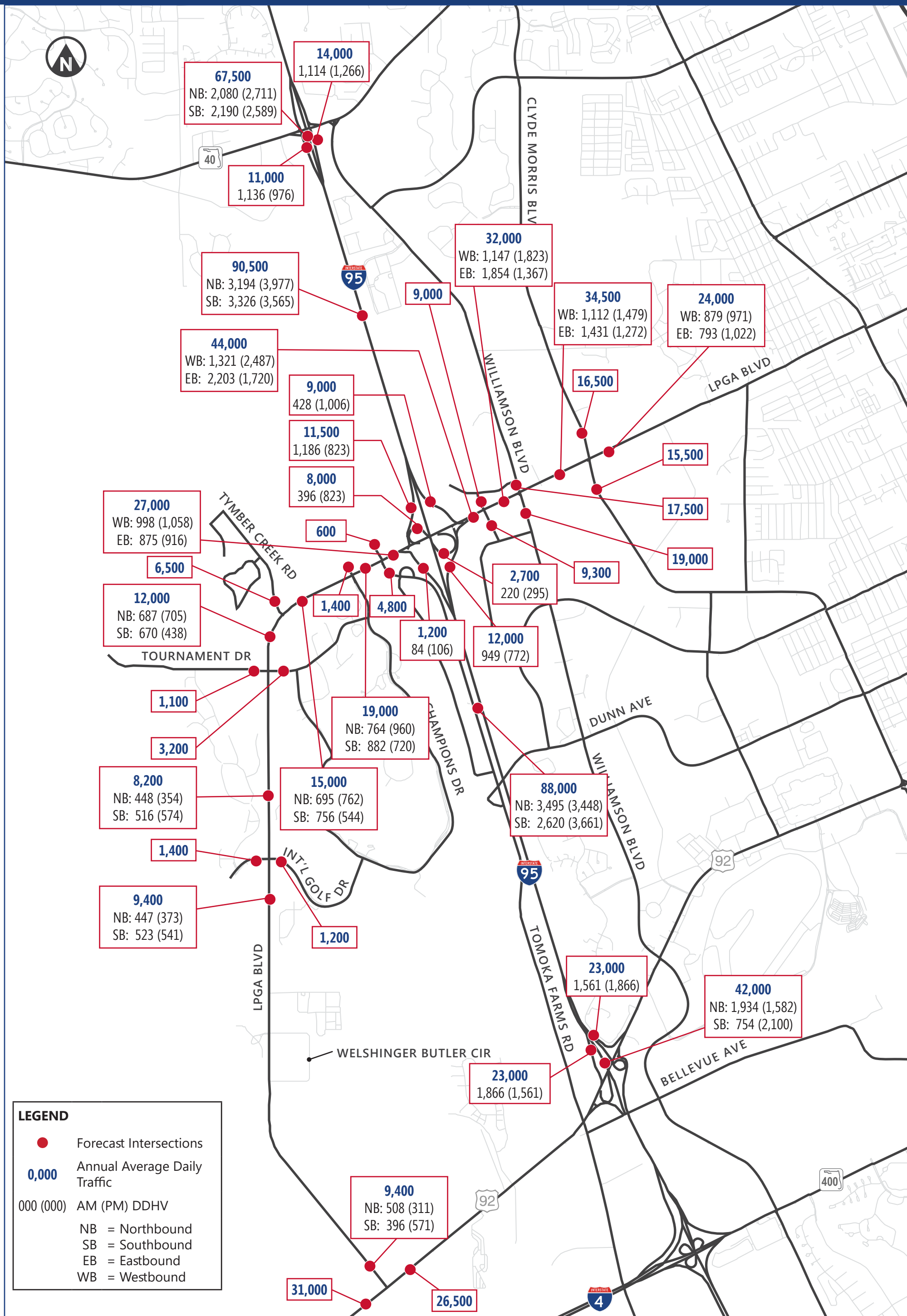
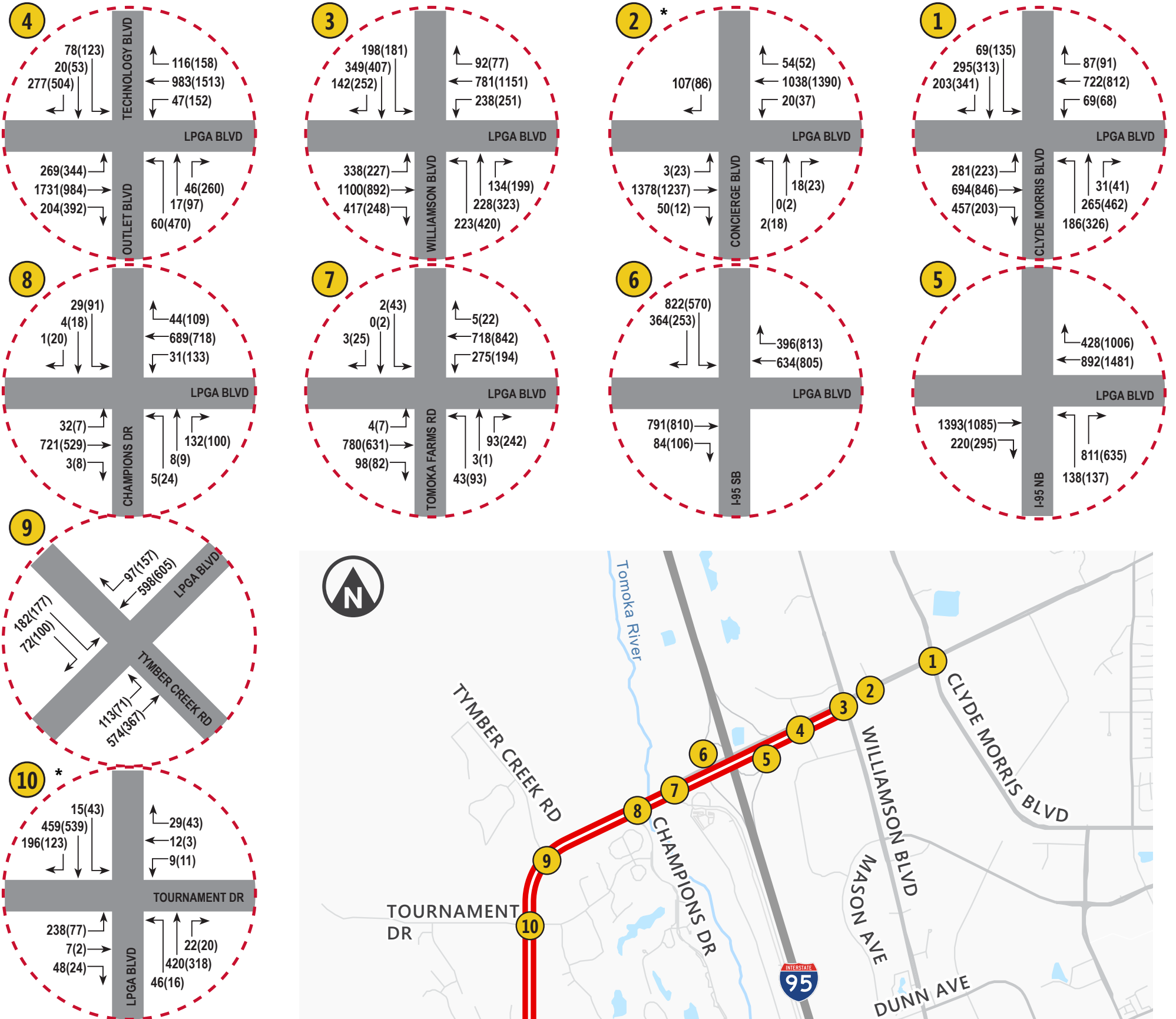


Figure 5. Existing Year 2021 AADT and DDHV

# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report



\*Note: Configuration differs from PTFM. Configuration was updated between PTFM development and operational analysis.

### LEGEND

- Study Intersections
- PD&E Limits

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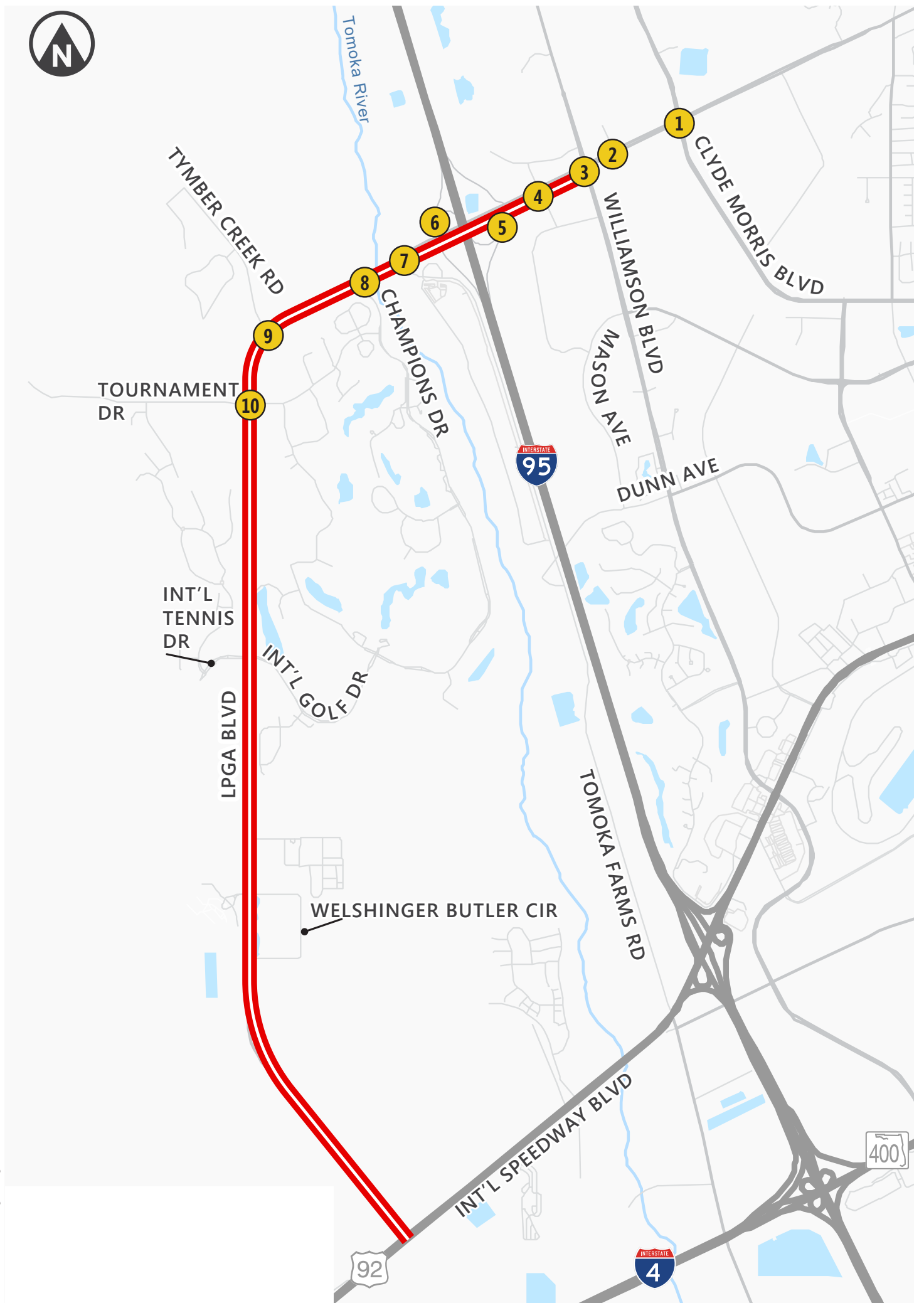
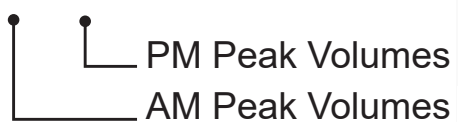


Figure 6. Existing Year 2021 TMV

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 3.2.3 Network Performance

Network results are in **Table 3**. There is no latent demand in either peak period, although the PM peak experiences more delay on average.

*Table 3. Network Results – Existing Year 2021*

Parameter	Existing Year 2021	
	AM	PM
<b>Hour 1</b>	<b>6:30 AM - 7:30 AM</b>	<b>3:45 PM - 4:45 PM</b>
Total Travel Time (hr)	601	1,208
Total Delay Time (hr)	103	294
Average Delay Time (s/veh)	46	69
Latent Demand (veh)	0	0
Average Speed (mph)	52	48
<b>Hour 2</b>	<b>7:30 AM - 8:30 AM</b>	<b>4:45 PM - 5:45 PM</b>
Total Travel Time (hr)	1,044	1,259
Total Delay Time (hr)	243	321
Average Delay Time (s/veh)	68	73
Latent Demand (veh)	0	0
Average Speed (mph)	48	47
<b>Hour 3</b>	<b>8:30 AM - 9:30 AM</b>	<b>5:45 PM - 6:45 PM</b>
Total Travel Time (hr)	905	928
Total Delay Time (hr)	174	188
Average Delay Time (s/veh)	54	56
Latent Demand (veh)	0	0
Average Speed (mph)	51	50

### 3.2.4 I-95 Mainline Operations

Volume and speed results were obtained using the Vissim link evaluation output. Volume and speed profiles shown in **Figure 7** through **Figure 10** indicate that in both directions (northbound and southbound) and both peak periods (three hours in the morning and afternoon), travel speeds are at or near 73 mph, except at interchange merge or diverge areas. At these locations, there is increased friction as drivers navigate the decision point, and speeds range between 60 and 70 mph. In the southbound direction in the PM peak, a sharper speed drop of 57 mph occurs at the eastbound to southbound on-ramp merge, given that the merge distance is only ~300-feet. Overall, the I-95 mainline, including merge and diverge areas, is operating under capacity. Comparison of the demand and the simulated volumes (throughput) along I-95 segments summarized in **Table 4** shows almost all demand in each segment is processed in the peak hour. Additionally, the estimated LOS per freeway segments presented in **Table 5** shows that I-95 segments are operating at LOS B or better in the existing conditions.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

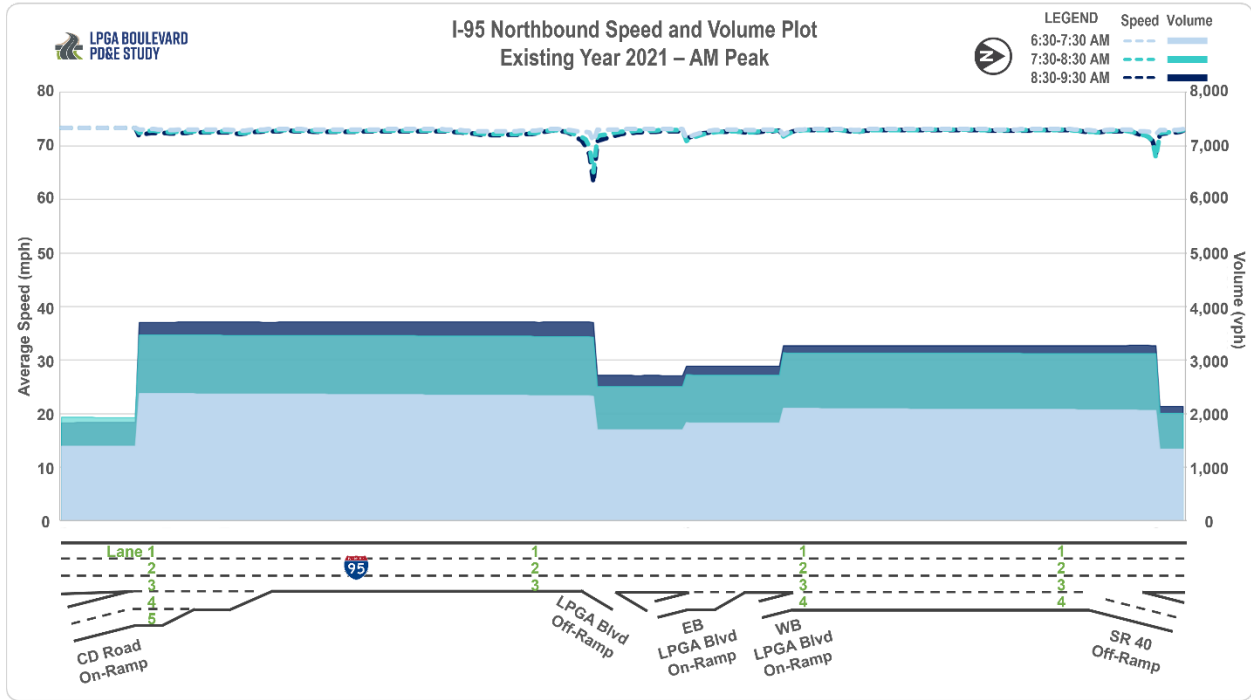


Figure 7. I-95 Northbound Speed and Volume Plot – Existing Year 2021 AM Peak

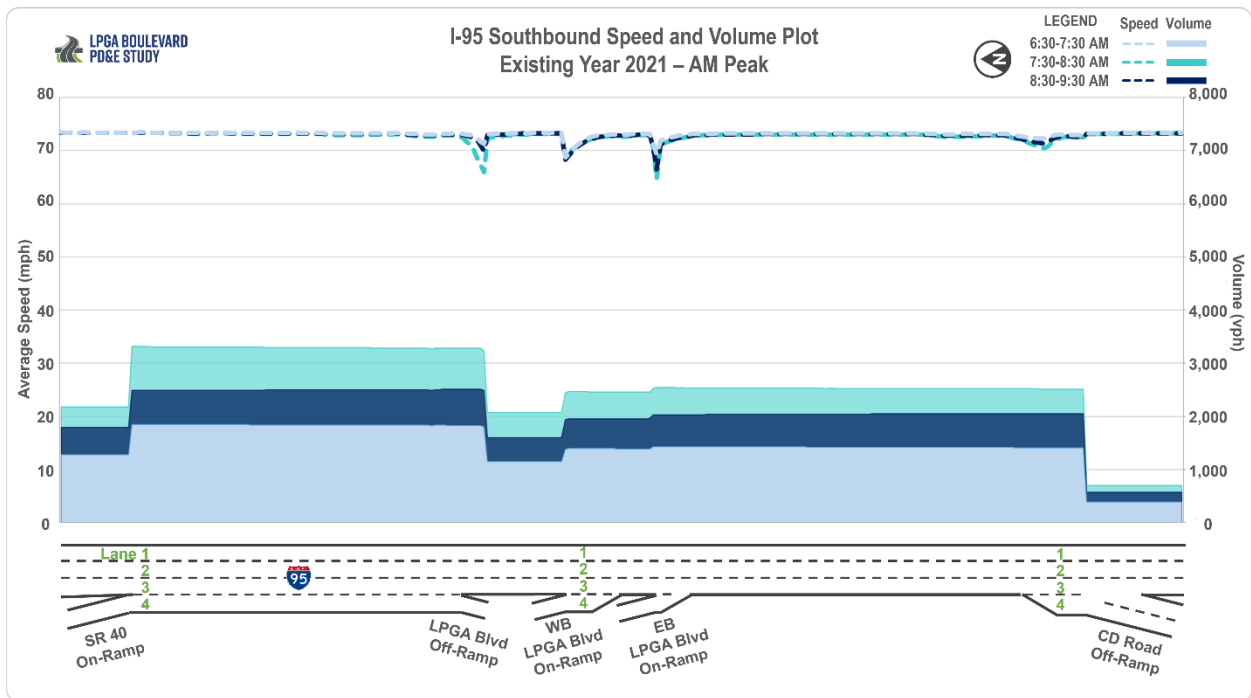


Figure 8. I-95 Southbound Speed and Volume Plot – Existing Year 2021 AM Peak

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

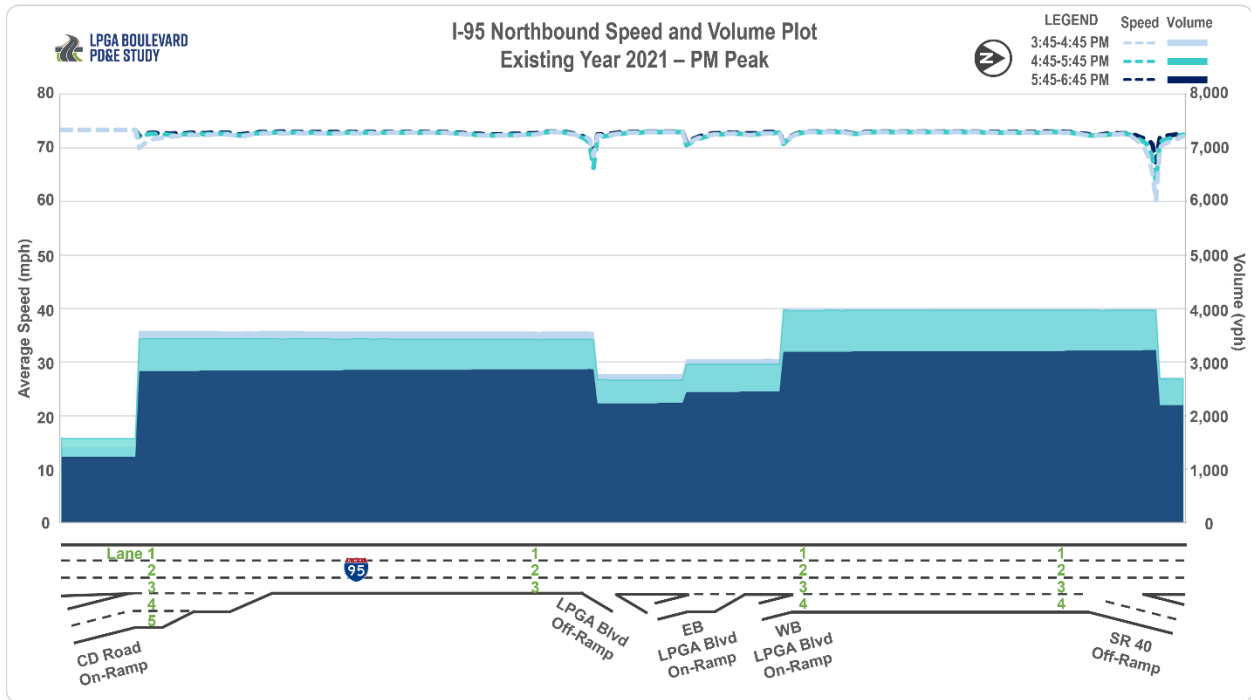


Figure 9. I-95 Northbound Speed and Volume Plot – Existing Year 2021 PM Peak

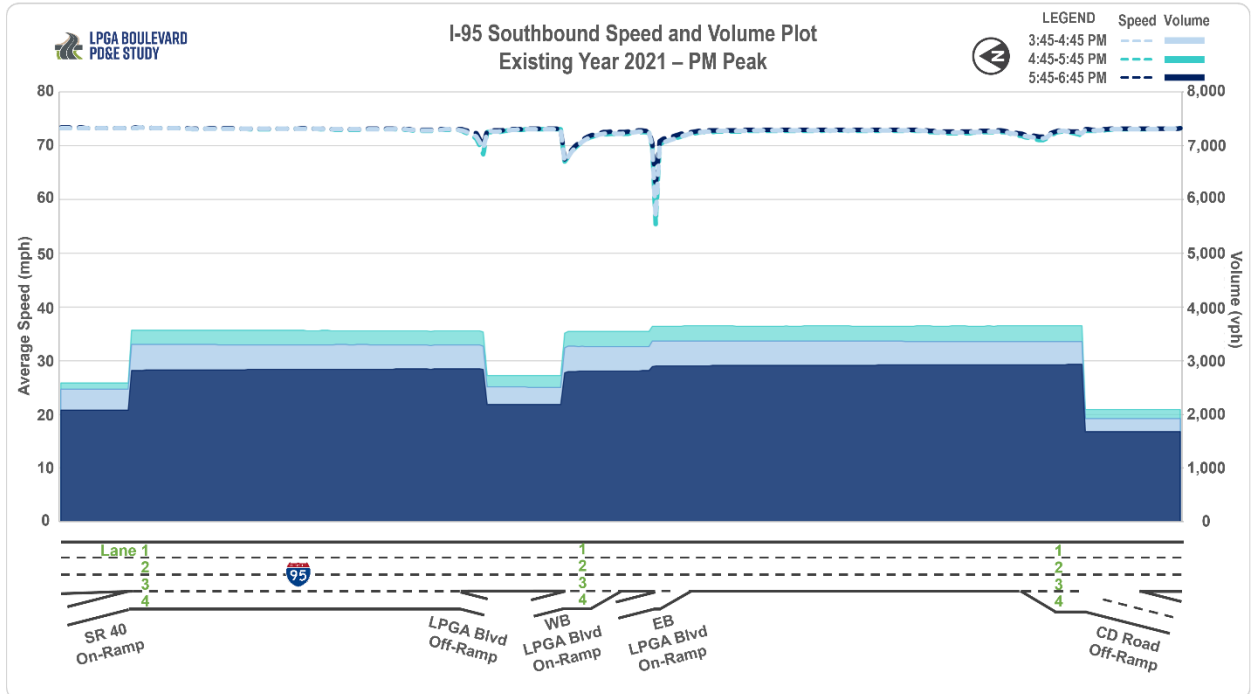


Figure 10. I-95 Southbound Speed and Volume Plot – Existing Year 2021 PM Peak

Table 4. I-95 Segments Demand and Simulated Volumes – Existing Year 2021

Alt	I-95 Segments	Segment Properties			Existing Year 2021			
		Dist <sup>1</sup> (mi)	Lanes	Type <sup>2</sup>	AM Peak Hour		PM Peak Hour	
					Demand (vph)	Simulated (vph)	Demand (vph)	Simulated (vph)
	<b>I-95 Southbound – Existing</b>							
I-95 SB Existing	Begin Study Area, North of SR 40 On-Ramp	0.5	3	Basic	2,190	2,182	2,589	2,589
	SR 40 On-Ramp	0.25	4	Basic	3,326	3,310	3,565	3,564
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	3,326	3,295	3,565	3,560
	LPGA Blvd Off-Ramp	0.25	4	Diverge	3,326	3,279	3,565	3,557
	From LPGA Blvd Off-Ramp to WB LPGA Blvd On-Ramp	0.5	3	Basic	2,140	2,073	2,742	2,725
	WB LPGA Blvd On-Ramp	0.25	4	Merge	2,536	2,463	3,555	3,541
	From WB LPGA Blvd On-Ramp to EB LPGA Blvd On-Ramp	0.25	3	Basic	2,536	2,462	3,555	3,542
	EB LPGA Blvd On-Ramp	0	4	Merge	2,620	2,539	3,661	3,642
	EB LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2	3	Basic	2,620	2,527	3,661	3,645
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	2,620	2,516	3,661	3,647
	End Study Area, South of US 92/I-4 CD Off-Ramp	0.5	3	Basic	754	700	2,100	2,087
	<b>I-95 Northbound – Existing</b>							
I-95 NB Existing	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	1,934	1,928	1,582	1,575
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	4	Merge	3,495	3,472	3,448	3,437
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	3,495	3,466	3,448	3,434
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.5	4	Basic	3,495	3,455	3,448	3,431
	From LPGA Blvd Off-Ramp to LPGA Blvd EB On-Ramp	0.25	3	Diverge	3,495	3,440	3,448	3,427
	LPGA Blvd EB On-Ramp	0.5	4	Basic	2,766	2,504	2,971	2,668
	LPGA Blvd EB On-Ramp to LPGA Blvd WB On-Ramp	0.25	3	Merge	2,766	2,721	2,971	2,961
	LPGA Blvd WB On-Ramp	0.25	4	Basic	2,766	2,718	2,971	2,957
	From LPGA Blvd WB On-Ramp to SR 40 Off-Ramp	0.25	3	Merge	3,194	3,134	3,997	3,962
	SR 40 Off-Ramp	1.25	4	Basic	3,194	3,129	3,997	3,965
	End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	3,194	3,119	3,997	3,966

1 Rounded to nearest 0.25 miles, 2 Assuming HCM segmentation types.

Table 5. I-95 Density and LOS – Existing Year 2021

Alt	I-95 Segments	Segment Properties			Hour 1 (6:30 AM - 7:30 AM)		Hour 2 (7:30 AM - 8:30 AM)		Hour 3 (8:30 AM - 9:30 AM)		Hour 1 (3:45 PM - 4:45 PM)		Hour 2 (4:45 PM - 5:45 PM)		Hour 3 (5:45 PM - 6:45 PM)		
		Dist <sup>1</sup> (mi)	Lanes	Type <sup>2</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	
<b>I-95 Southbound – Existing</b>																	
Existing	I-95 SB	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	5.8	A	9.9	A	8.1	A	11.2	B	11.8	B	9.5	A
		SR 40 On-Ramp	0.25	4	Basic	6.3	A	11.3	B	8.5	A	11.3	B	12.2	B	9.6	A
		From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	6.3	A	11.3	B	8.5	A	11.3	B	12.2	B	9.7	A
		LPGA Blvd Off-Ramp	0.25	4	Diverge	6.3	A	11.5	B	8.6	A	11.4	B	12.3	B	9.8	A
		From LPGA Blvd Off-Ramp to WB LPGA Blvd On-Ramp	0.50	3	Basic	5.2	A	9.5	A	7.3	A	11.5	B	12.5	B	10.0	A
		WB LPGA Blvd On-Ramp	0.25	4	Merge	4.9	A	8.6	A	6.9	A	11.6	B	12.6	B	9.9	A
		From WB LPGA Blvd On-Ramp to EB LPGA Blvd On-Ramp	0.25	3	Basic	6.3	A	11.3	B	9.0	A	15.0	B	16.3	B	12.9	B
		EB LPGA Blvd On-Ramp	0.00	4	Merge	5.1	A	9.4	A	7.4	A	13.5	B	14.8	B	10.9	B
		EB LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2.00	3	Basic	6.5	A	11.6	B	9.4	A	15.4	B	16.8	B	13.4	B
		US 92/I-4 CD Off-Ramp	0.25	4	Diverge	4.8	A	8.7	A	7.1	A	11.6	B	12.6	B	10.1	B
	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	1.8	A	3.2	A	2.6	A	8.7	A	9.5	A	7.6	A	
<b>I-95 Northbound – Existing</b>																	
Existing	I-95 NB	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	6.3	A	8.8	A	4.2	A	6.4	A	7.2	A	2.8	A
		US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	4	Merge	6.5	A	7.2	A	5.1	A	10.0	A	7.1	A	3.9	A
		US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	8.1	A	9.5	A	6.4	A	12.3	B	9.5	A	4.9	A
		From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.50	4	Basic	10.8	A	15.8	B	8.2	A	16.4	B	15.7	B	6.3	A
		From LPGA Blvd Off-Ramp to LPGA Blvd EB On-Ramp	0.25	3	Diverge	10.7	B	16.0	B	8.7	A	16.4	B	15.9	B	6.6	A
		LPGA Blvd EB On-Ramp	0.50	4	Basic	7.8	A	11.5	B	6.3	A	12.7	B	12.2	B	5.1	A
		LPGA Blvd EB On-Ramp to LPGA Blvd WB On-Ramp	0.25	3	Merge	6.3	A	9.4	A	5.0	A	10.6	B	10.3	B	4.2	A
		LPGA Blvd WB On-Ramp	0.25	4	Basic	8.3	A	12.5	B	6.6	A	14.0	B	13.6	B	5.6	A
		From LPGA Blvd WB On-Ramp to SR 40 Off-Ramp	0.25	3	Merge	7.2	A	10.8	B	5.6	A	13.8	B	13.6	B	5.5	A
		SR 40 Off-Ramp	1.25	4	Basic	7.1	A	10.7	A	5.6	A	13.7	B	13.6	B	5.5	A
	End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	7.1	A	10.8	A	5.7	A	14.2	B	13.9	B	5.6	A	

<sup>1</sup>Rounded to nearest 0.25 miles, <sup>2</sup>Assuming HCM segmentation types,

<sup>3</sup>LOS thresholds based on Vissim density in vehicles per mile per lane: HCM Basic Freeway — LOS A (≤11), LOS B (>11-18), LOS C (>18-26), LOS D (>26-35), LOS E (>35-45), LOS F (>45);

HCM Merge/Diverge — LOS A (≤10), LOS B (>10-20), LOS C (>20-28), LOS D (>28-35), LOS E (>35), LOS F (demand exceeds capacity)

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### 3.2.5 LPGA Boulevard Arterial Operations

The average travel time and speed is shown in **Table 6**. The slower travel time of 7.7 minutes in the eastbound direction during the AM peak hour is due to the two-lane LPGA Boulevard segment west of I-95, where traffic backs up between Tomoka Farms Road and Tymber Creek Road. The congestion is also due to a heavy westbound left-turn movement at Tomoka Farms Road that prevents longer green time for the eastbound movement.

*Table 6. LPGA Travel Time and Speed – Existing Year 2021*

Dir	Segment	Dist	AM Peak Hour		PM Peak Hour	
			Travel Time	Avg Speed	Travel Time	Avg Speed
EB	From Tournament Dr to Clyde Morris Blvd	2.5 mi	7.7 min	19.6 mph	5.9 min	25.5 mph
WB	From Clyde Morris Blvd to Tournament Dr	2.5 mi	5.8 min	26.0 mph	7.2 min	20.9 mph

### 3.2.6 Intersection Operations

Intersection operations were evaluated by comparing intersection delay and the level of service thresholds presented in Table 7, consistent with the HCM 6<sup>th</sup> Edition. It is noted that estimated LOS are calculated from Vissim output results.

*Table 7. LOS Thresholds for Signalized and Unsignalized Intersections*

LOS	Intersection Delay (Seconds)	
	Signalized	Unsignalized
<b>A</b>	≤10	≤10
<b>B</b>	>10 - 20	>10 - 15
<b>C</b>	>20 - 35	>15 - 25
<b>D</b>	>35 - 55	>25 - 35
<b>E</b>	>55 - 80	>35 - 50
<b>F</b>	>80	>50

Existing Year 2021 intersection LOS and delay results are in **Table 8**. Ramp terminal queue length results are in **Table 9**. Detailed results by movement, including queue length, are in **Appendix I**.

Results show that most intersections operate at LOS D or better. The ramp terminal intersections operate at LOS C or better. All intersections, except for Concierge Boulevard, are signalized. Consistent with the volume patterns, most intersections have less delay in the first or third hour compared to the peak hour.

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Table 8. Intersection Delay and LOS – Existing Year 2021

LPGA Blvd Intersection	2021 Existing					
	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
AM Peak Period	Hour 1 (6:30AM - 7:30AM)		Hour 2 (7:30AM - 8:30AM)		Hour 3 (8:30AM - 9:30AM)	
Tournament Dr	17.9	B	30.4	C	17.4	B
Tymber Creek Rd	11.5	B	25.3	C	19.8	B
Champions Dr	5.9	A	46.7	D	10.2	B
Tomoka Farms Rd	9.5	A	32.2	C	17.7	B
I-95 SB Ramps	25.4	C	32.4	C	28.6	C
I-95 NB Ramps	17.6	B	22.4	C	25.0	C
Technology Blvd	18.8	B	20.5	C	22.4	C
Williamson Blvd	44.8	D	53.4	D	47.8	D
Concierge Blvd*	10.0	B	17.0	C	13.6	B
Clyde Morris Blvd	30.2	C	38.1	D	35.3	D
PM Peak Period	Hour 1 (3:45 PM - 4:45 PM)		Hour 2 (4:45 PM - 5:45 PM)		Hour 3 (5:45 PM - 6:45 PM)	
Tournament Dr	13.1	B	12.7	B	10.1	B
Tymber Creek Rd	16.1	B	16.2	B	13.4	B
Champions Dr	18.7	B	19.6	B	16.9	B
Tomoka Farms Rd	37.1	D	40.4	D	23.3	C
I-95 SB Ramps	25.1	C	26.5	C	25.4	C
I-95 NB Ramps	31.6	C	29.5	C	30.0	C
Technology Blvd	47.3	D	51.0	D	39.4	D
Williamson Blvd	59.3	E	64.3	E	52.2	D
Concierge Blvd*	16.7	C	100.0	F	13.1	B
Clyde Morris Blvd	45.8	D	47.4	D	36.0	D

\*Worst movement delay reported (stop control intersection)

Table 9. Ramp Terminal Queues – Existing Year 2021

I-95 Ramp Terminal	Mvmnt	Existing Year 2021		
		Avg Queue AM (PM)	Max Queue AM (PM)	Storage* Turn Bay / Off-Ramp
Southbound Ramp Terminal	EBT	103 (50)	577 (437)	-
	EBR	- (-)	- (-)	500 ft
	WBL	64 (71)	435 (601)	675 ft
	WBT	- (-)	- (-)	-
	SBL	168 (135)	785 (613)	2,500 ft
	SBR	2 (12)	173 (194)	300 ft / 2,500 ft
Northbound Ramp Terminal	EBL	63 (46)	635 (616)	775 ft
	EBT	- (-)	- (-)	-
	WBT	18 (79)	215 (552)	-
	WBR	- (-)	- (-)	725 ft
	NBL	32 (32)	151 (145)	800 ft / 2,775 ft
	NBR	159 (188)	549 (589)	625 ft / 2,775 ft

\*Turn bays measured from stop bar to end of taper; Off-ramps measured from stop bar to gore point

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### 4.0 Future Traffic Forecasts

Future forecasted volumes were developed based on procedures identified in the *2019 FDOT Project Traffic Forecasting Handbook* using the CFRPM 7. A sub area model was developed to validate the base year model. The model validation results are summarized in the I-95 at US 1 and LPGA Boulevard Traffic Demand Forecasting Documentation (**Appendix D**) that was prepared as part of this project. Future year forecasted volumes were developed to represent the expected travel demand, and a single set of volumes was used for No-Build and Build.

#### 4.1 Socioeconomic Model Data Review

A thorough review of CFRPM 7 was conducted in coordination with the local planning agencies and the River to Sea Transportation Planning Organization (R2CTPO). A review of CFRPM 7 was done to ensure reasonableness between the model and the 2015 field conditions. Population, population density, employment and employment density were inspected by using Google Earth imagery for each traffic analysis zone (TAZ) within the study area. Upon review, it was determined that the model showed reasonableness within the study area and no changes were necessary for the year 2015 CFRPM model socioeconomic data.

Population and employment data from the 2045 CFRPM model were also compared with the 2015 base year data to check for any discrepancies. A considerable amount of the zones show substantial development in the study area. The future year 2045 socioeconomic data for 15 TAZs were updated in the 2045 model based on the coordination with City of Daytona Beach, City of Ormond Beach, and Volusia County planning staff.

#### 4.2 Future Roadway Network Review

The CFRPM network was reviewed for connectivity, area type, functional classification, number of lanes and turn prohibitors. Although certain changes were made for the base year 2015 model validation purposes which are discussed later, it was determined that no changes to the roadway network needed to be made to the 2015 base year network to incorporate the year 2015 field roadway conditions.

The 2045 R2CTPO Long Range Transportation Plan (LRTP) and Fiscal Year (FY) 2022/23 to FY 2026/27 Transportation Improvement Program (TIP) were compared against the planning horizon (2045) Cost Feasible Plan model to achieve a baseline. The 2045 Cost Feasible Plan model was checked against the following projects:

- I-95 Interchange at SR 5 (US 1) – PD&E/EMO Study
- I-95 at Maytown Road – New interchange – PD&E/EMO Study
- I-95/SR 9 From south of Bridge 790079 to Flagler County line – Resurfacing
- I-95/SR 9 From South of Dunn Avenue to Airport Road – Resurfacing
- I-95 – 0.5 miles north of SR 44 to 1.6 miles north of US 92 – Add lanes and reconstruct
- I-95 Interchange at Pioneer Trail – New Interchange
- US 1 – Resurfacing from Woodland Ave to Flagler County Line
- I-95 at LPGA Boulevard Interchange – PD&E/EMO Study

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- US 1 from Nova Rd (North) to I-95 – Widen to six lanes
- LPGA from US 92 to Williamson Boulevard – PD&E Study. Improvements are part of the Cost Feasible Plan.
- SR 600 (US 92) from I-4 EB Ramp to Tomoka Farms Road – Widen to six lanes
- SR 40 from Breakaway Trail to Williamson Boulevard – Widen to six lanes
- SR 600 (US 92) at Williamson Boulevard – Intersection improvement
- SR 40 from Interchange Boulevard to I-95 Southbound Ramps – Turn lane improvement
- SR 483 (Clyde Morris Boulevard) from SR 400 (Beville Road) To US 92 – Corridor improvement (Add lanes)
- US 92 from I-4 Eastbound Ramp to CR 415 (Tomoka Farms Road) – Widen to six lanes
- Tomoka River Bridge (LPGA) West of Champions Drive to East of Tomoka Farms Road – Bridge to match interchange configuration

After review, the additional lanes along I-95 from north of US 92 to SR 44, and the additional lanes for SR 483 from SR 400 to US 92 were found to be excluded from the 2045 Cost Feasible Plan model. The 2045 Cost Feasible Plan model was updated to reflect these changes. Along with the changes mentioned above, the same validation revisions that were completed in the base year 2015 model were also incorporated into the year 2045 model.

### 4.3 Subarea Model Validation

Before utilizing the travel demand model to develop the project traffic forecasts, the base year (2015) model outputs were verified for reasonableness at the regional and project levels. When the model results are not reasonable compared to the observed traffic conditions at the regional level, the model will be determined to be unacceptable and other means of traffic forecasting should be investigated. For this reason, base year model performance was compared at the regional level prior to the project level following the criteria provided in the FDOT Project Traffic Forecasting Handbook.

The validation measures included the volume-to-count (V/C) ratio by facility types and by screenlines/cut lines. In this regard, the area type, facility type, and lane capacities were reviewed for any abnormalities. Furthermore, through an iterative process, the accuracy of the project area traffic forecast was improved by adjusting centroid locations and adding additional turn penalties.

All the model-estimated traffic volumes expressed in peak seasonal week average daily traffic (PSWADT) and the count data were found to be within the preferable range of FDOT standards as illustrated in the I-95 at US 1 and LPGA Boulevard Traffic Demand Forecasting Documentation (**Appendix D**). Based on the analysis of the base year 2015 outputs, most of the validation performance measures met the regional standards identified in the FDOT Project Traffic Forecasting Handbook. Therefore, it was determined that using CFRPM 7 was acceptable at a regional level for use in the traffic analysis.

Upon comparing the PSWADT V/C ratios within the subarea level, it was determined that the CFRPM 7 predicted volumes were within the acceptable error levels and met the validation performance measure standards provided by the FDOT Project Traffic Forecasting Handbook.

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At the project area level, the model volumes on both the I-95 mainline, ramps and the LPGA segments were compared individually to the observed counts using the V/C ratio. Most of the links had the V/C ratios within the acceptable error levels.

### 4.4 Future Year Volumes and Growth Rate

The future year methodology was developed in coordination with FDOT. Future year forecasted volumes were developed to represent the expected travel demand, and a single set of volumes was used for No-Build and Build. Future year AADT volumes were developed for the following scenarios:

- Opening Year: 2030
- Design Year: 2050

Growth rates, shown in **Table 10**, were used as a basis to estimate future year AADT volumes in the study area. Growth rates were used instead of direct model output given that base year model validation is done for specific control points and not all locations. Using growth rates also provided the ability to blend with other sources. The CRFPM 7 outputs from 2015 model and 2045 model were used in combination with the estimated historical traffic growth rates and the Bureau of Economic and Business Research (BEBR) population growth rates, as summarized here and documented in detail in the PTFM (included in **Appendix D**).

- As the study area has already seen significant growth since 2015 when CRFPM 7 was developed, the growth between 2015 and 2021 was estimated and compared with the 2045 volumes. Other data sources such as Volusia County counts or data collected from previous studies within the study area were used in locations where the CRFPM 7 did not have 2015 traffic count data.
- In cases where the 2045 model volumes were less than 2021, the growth rate was adjusted based on the growth observed on adjacent links on the same roadway, or trend analysis which had R-square values greater than 75%.
- The established growth rate was then applied to the existing 2021 counts to develop 2045 volumes.
- BEBR growth rates were used to grow the volumes from 2045 to 2050.
- Additionally, the Traffic Impact Analyses (TIA) were consulted to establish future daily volumes for Tournament Drive, International Tennis Drive, International Golf Drive, Tymber Creek Road, Technology Drive, Williamson Boulevard, and Clyde Morris Boulevard. More information regarding the planned developments is provided in the PTFM in **Appendix D**.
- 2030 daily traffic volumes were interpolated between 2021 and 2050 volumes

The resulting Opening Year 2030 and Design Year 2050 AADT volumes were then balanced and refined, as appropriate. The resulting projected AADT volumes with adjustments are shown in **Figure 11** and **Figure 12**.

#### 4.5 Future Design Hour Volumes

Future year directional design hour volumes (DDHV) were developed by applying K and D factors (**Table 1**) to the projected AADTs. The resulting volumes were balanced and adjusted as necessary throughout the LPGA Boulevard corridor and I-95. DDHVs for opening year (2030) and design year (2050) are shown in **Figure 11** and **Figure 12**.

#### 4.6 Future Peak Hour Turning Movement Volumes

The peak hour intersection turning movement traffic volumes for future years (2030 and 2050) were estimated utilizing the existing year turning movement count data and the future design hour traffic volumes. The FDOT Turns5 spreadsheet was used to estimate future year peak hour intersection turning movement volumes.

The existing turning movement counts provided a data-based starting point for establishing traffic patterns, while the future design hour traffic volumes provided the magnitude of the future traffic volumes. The analysis area for LPGA Boulevard is slated to receive a substantial number of new developments which will have the effect of increasing the trips along LPGA Boulevard. A significant number of these trips is estimated to come from the area north of Tymber Creek Road. To address the effects of these changes, the future year turning movement volume estimates should reflect a combination of existing travel patterns (based on existing counts) along with anticipated growth and changes in travel patterns within the analysis area. As such, additional refinements were made to the DDHVs and turning movement volumes to ensure that land development changes were properly incorporated in the project design traffic. The resulting turning movement volumes were balanced along the LPGA Boulevard corridor ensuring a consistent approach and output for the entire project area. Where movements were no longer possible in the Build Alternative due to an innovative intersection concept, volumes were rerouted. For instance, the northbound through and northbound left-turn at Tomoka Farms Road is rerouted to a u-turn location at the southbound ramp terminal. The Build Alternative is discussed further in *Section 5.3*. Turning movement volumes for the AM and PM peak hours are shown in **Figure 13** through **Figure 16**.

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Table 10. Growth Rates and 2050 Volumes

Roadway	Count Location	2015 Volumes		2045 Volumes	2021 Traffic Counts	Adjusted Growth to project 2015 to 2021	Projected 2021 Model Volume	2021 to 2045 Recommended Growth Rate	2045 to 2050 Growth Rate	Balanced 2050 AADT
		Model	Counts	Model						
I-95	North of LPGA Blvd.	83,900	81,161	139,185	85,500	1.34%	88,385	2.23%	0.41%	138,000
	South of LPGA Blvd.	71,364	74,825	119,741	75,830	0.22%	72,322	2.99%	0.41%	133,000
LPGA Blvd.	US 92 to International Tennis Dr.	7,913	8,019	29,714	9,390	2.85%	9,265	9.20%	0.84%	32,000
	Tournament Dr. to International Tennis Dr.	8,916	-	32,676	8,192	2.85%	10,440	8.87%	0.84%	27,000
	Tournament Dr. to Tymber Creek Rd.	9,101	9,540	32,676	11,777	3.91%	11,235	7.95%	0.84%	36,000
	Tymber Creek Rd. to Champions Dr.	9,101	9,300	46,385	14,930	10.09%	14,611	9.06%	0.84%	50,000
	Champions Dr. to Tomoka Farm Rd.	10,966	9,300	57,978	18,809	17.04%	22,178	6.73%	0.84%	52,000
	West of I-95	14,838	17,469 <sup>1</sup>	50,189	26,929	13.54%	26,891	3.61%	3.61%	56,000
	East of I-95	21,984	38,400 <sup>1</sup>	60,954	43,990	3.64%	24,384	2.89% <sup>2</sup>	0.84%	78,000
	Technology Blvd./Outlet Blvd. to N Williamson Blvd.	20,892	26,964	41,868	31,904	3.05%	24,719	3.35%	0.84%	60,000
	N Williamson Blvd. to Clyde Morris Blvd.	26,472	22,617	42,841	34,314	8.62%	40,163	1.89%	0.84%	52,000
	East of Clyde Morris Blvd.	12,317	17,110	25,817	24,210	6.92%	17,428	2.01%	0.84%	38,000
I-95 Ramps	Southbound Off Ramp	7,273	8,380	15,765	11,687	6.58%	10,143	3.26%	0.84%	22,000
	Southbound On Ramp from WB LPGA Blvd.	1,026	4,520	2,495	8,025	12.93%	1,822	3.64%	0.84%	16,000
	Southbound On Ramp from EB LPGA Blvd.	133	640	3,153	1,243	15.71%	258	3.64%	0.84%	3,000
	Northbound Off Ramp	2,674	6,193	4,346	11,800	15.09%	5,095	3.61%	0.84%	23,000
	Northbound On Ramp from WB LPGA Blvd.	6,400	5,261	11,978	9,019	11.91%	10,972	4.52%	0.84%	19,000
	Northbound On Ramp from EB LPGA Blvd.	2,832	1,583	1,903	2,731	12.09%	4,886	3.72%	0.84%	6,000
Tymber Creek Rd.	North of LPGA Blvd.	0	-	45,183	6,459	-	-	24.98%	0.84%	33,000
	South of LPGA Blvd. <sup>3</sup>	-	-	-	-	-	-	-	-	13,000
Champions Dr.	South of LPGA Blvd.	1,875	-	13,803	1,754	-	-	-	-	4,500
	North of LPGA Blvd.	-	-	12,912	1,413	-	-	5.77%	0.76%	3,500
Tomoka Farms Rd.	North of LPGA Blvd.	61	-	265	605	0.94%	64	9.85%	1.60%	3,000
	South of LPGA Blvd.	3,712	4,576	13,916	4,833	0.94%	3,921	11.21%	0.41%	15,000
Technology Blvd.	North of LPGA Blvd.	435	-	2,419	9,000	2.17%	492	-	-	25,000
Outlet Blvd.	South of LPGA Blvd.	661	-	19,710	9,288	2.17%	747	5.50%	0.41%	22,000
Williamson Blvd.	North of LPGA Blvd.	11,922	13,300	25,023	17,522	2.17%	13,477	3.66%	0.41%	34,000
	South of LPGA Blvd.	17,173	16,630	25,741	18,800	2.17%	19,414	3.87%	0.41%	37,000
Clyde Morris Blvd	North of LPGA Blvd.	14,563	13,440	18,266	16,520	2.17%	16,463	2.50%	0.41%	27,000
	South of LPGA Blvd.	16,678	12,944	23,807	15,513	2.17%	18,854	2.67%	0.41%	26,000
International Tennis Dr.	North of LPGA Blvd.	2,523	-	14,736	1,378	-	-	15.42%	1.60%	7,000
International Golf Dr.	South of LPGA Blvd.	2,971	-	11,516	1,246	-	-	14.40%	1.60%	6,000
Tournament Dr.	West of LPGA Blvd.	289	-	-	1,133	-	-	23.06%	1.60%	8,000
	East of LPGA Blvd.	-	-	-	3,242	-	-	2.97%	1.60%	6,000

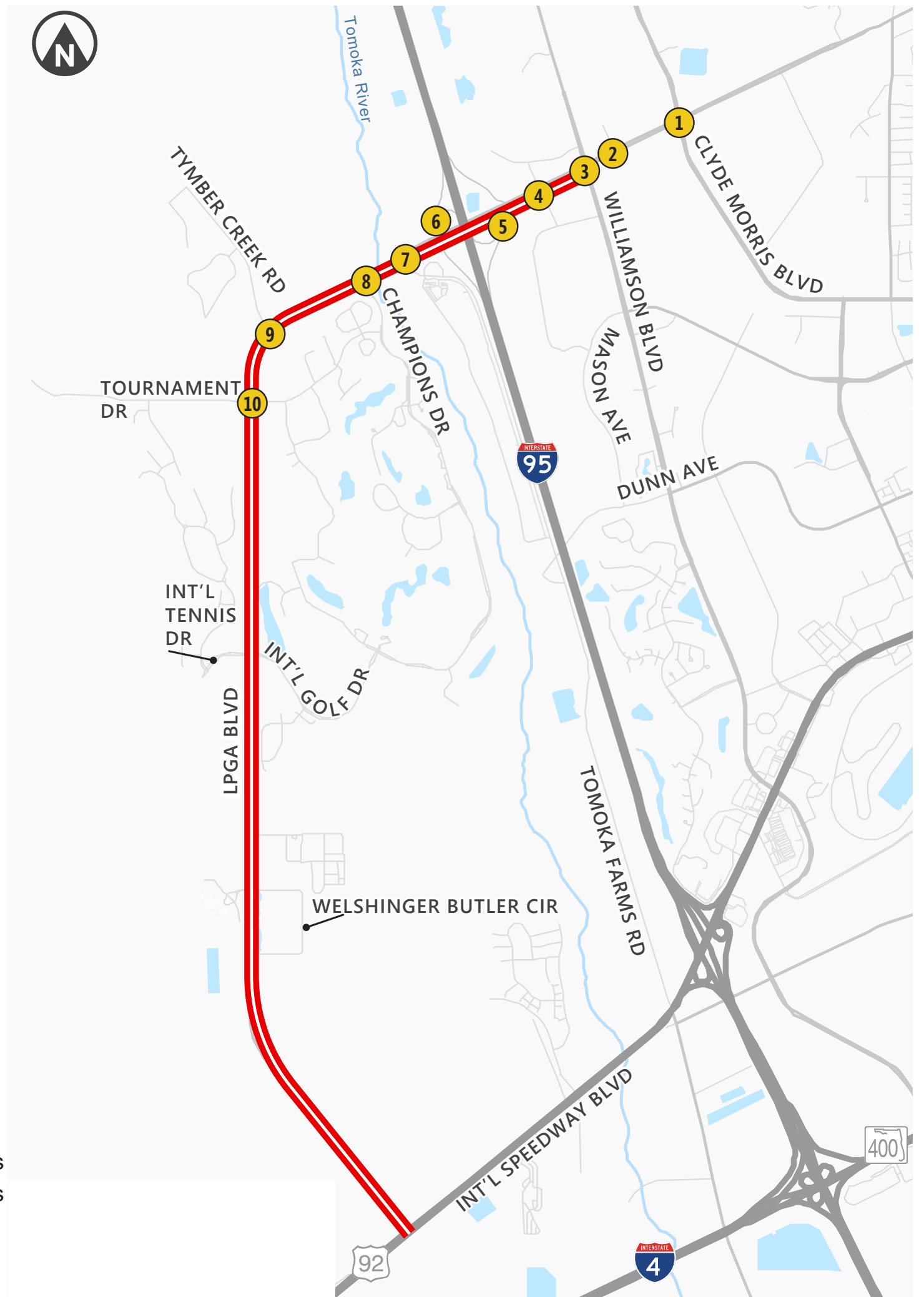
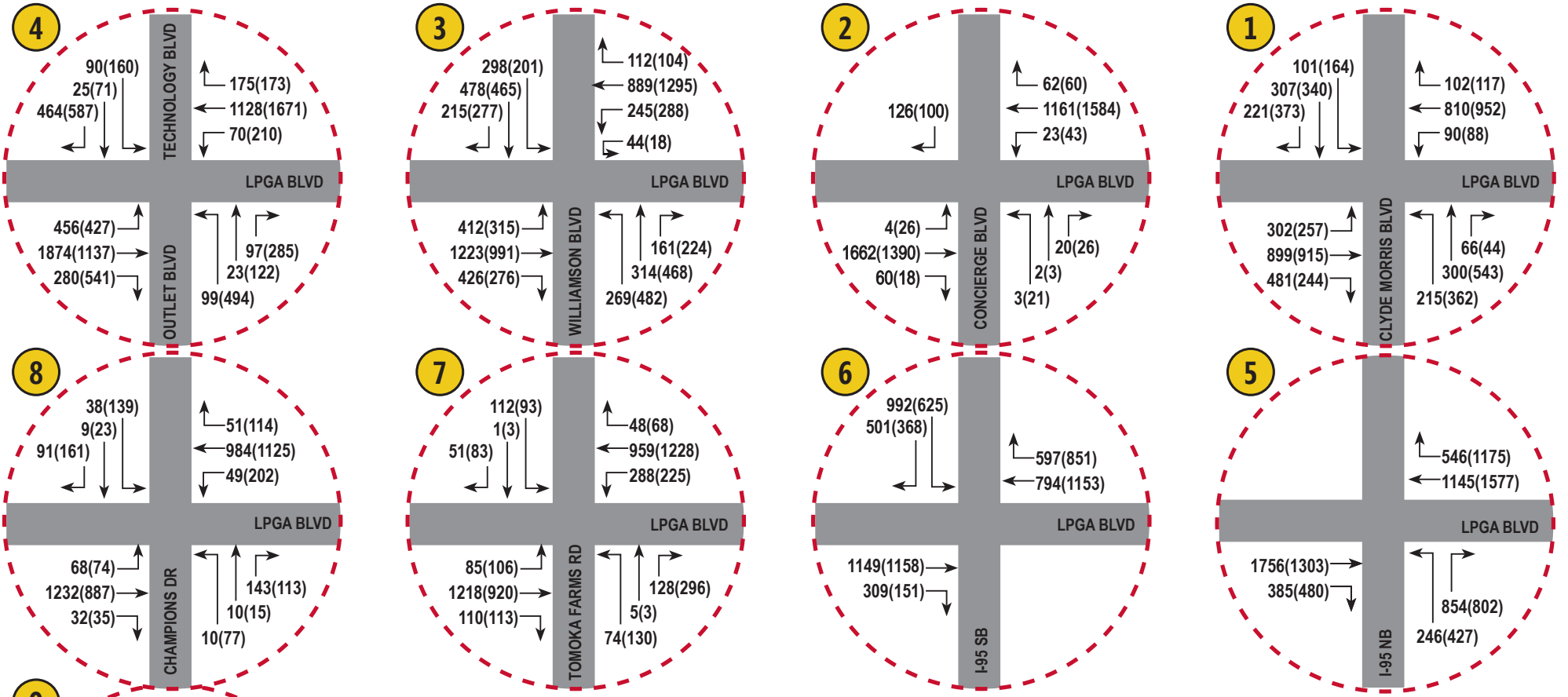
<sup>1</sup> Used 2017 AADT and calculated growth from 2017; <sup>2</sup> Used the growth rate for segment between Technology Boulevard/Outlet Boulevard and Williamson Boulevard; <sup>3</sup> Trips derived from Tymber Creek Village TIA.





# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report



### LEGEND

- X Study Intersections
- PD&E Limits

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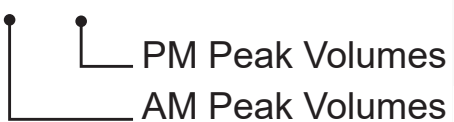
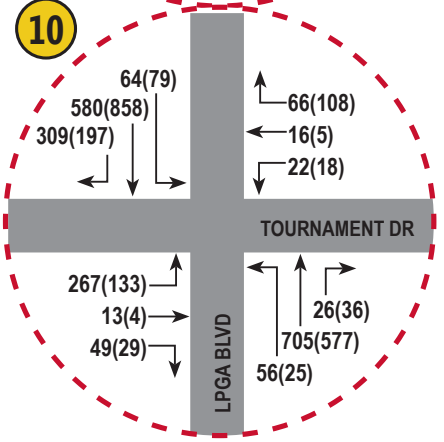
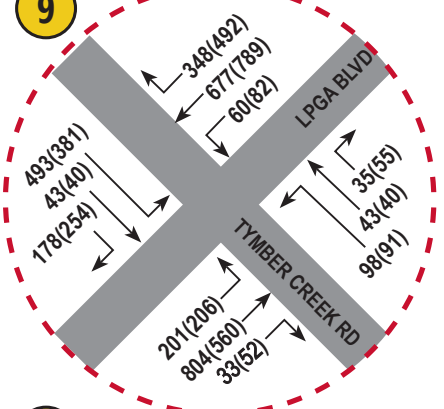
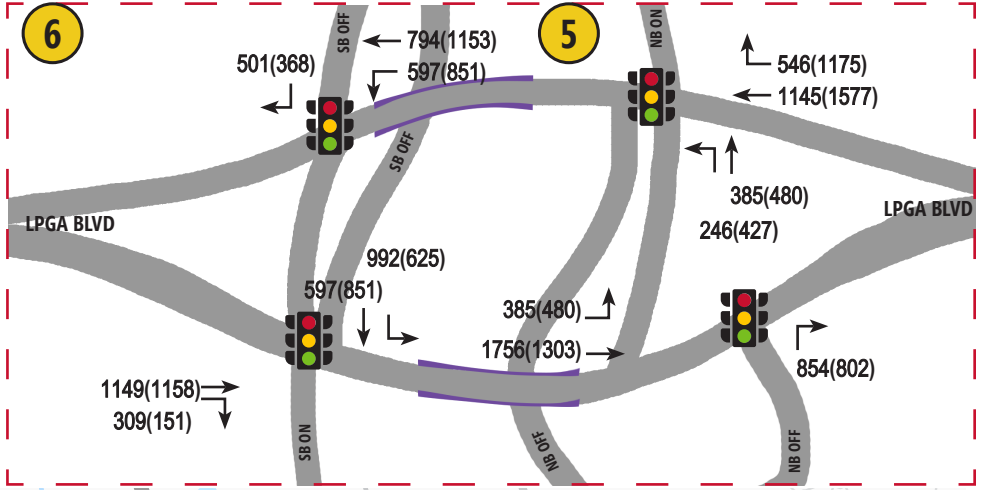
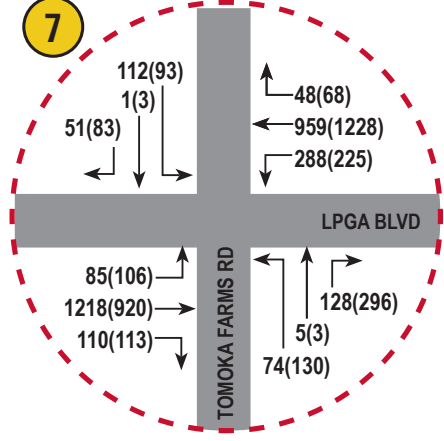
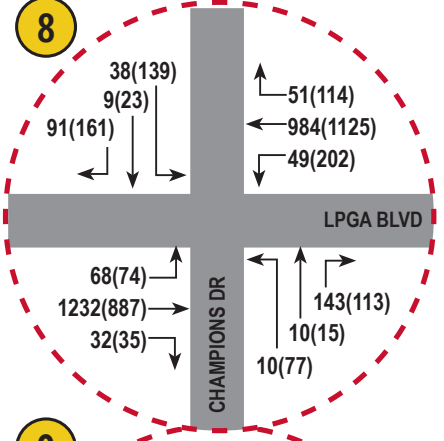
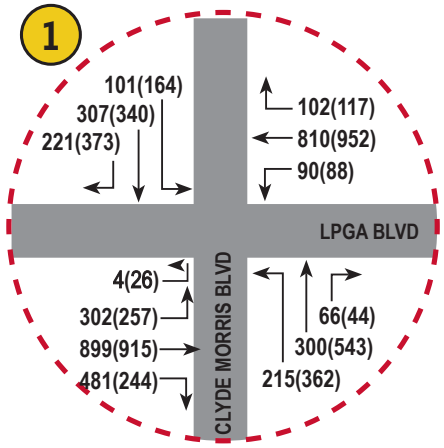
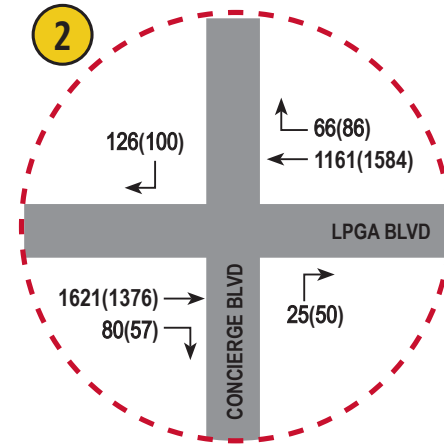
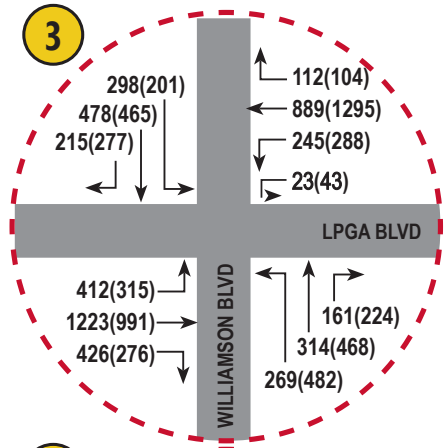
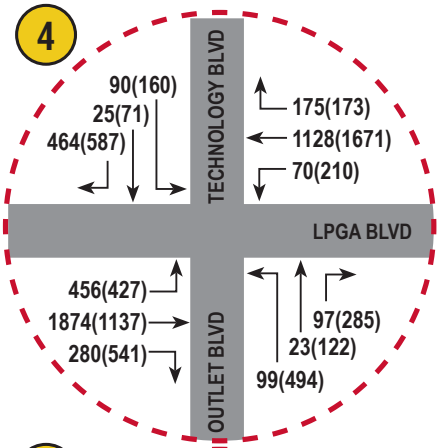
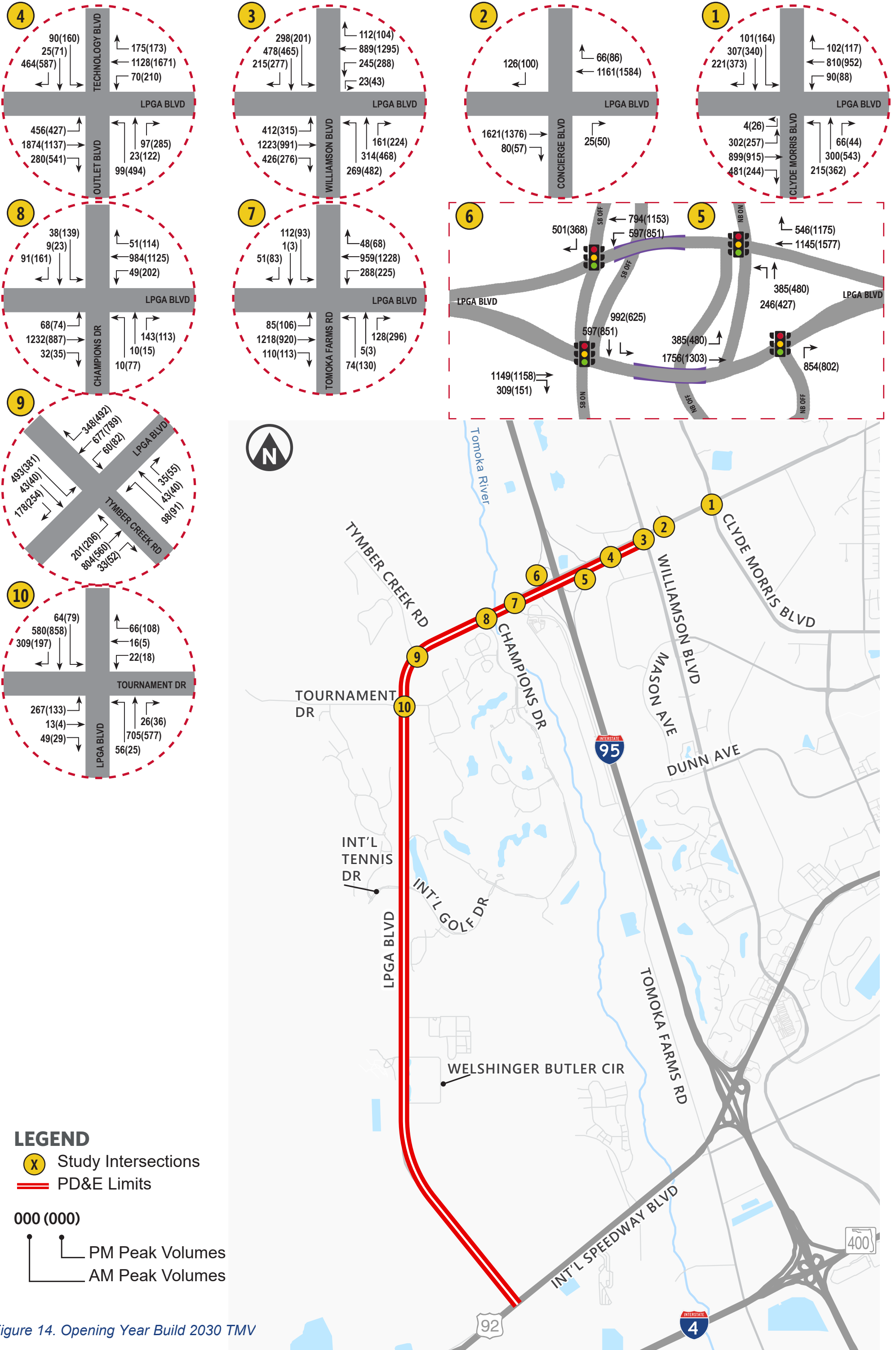


Figure 13. Opening Year 2030  
 TMV - No-Build

# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report



# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

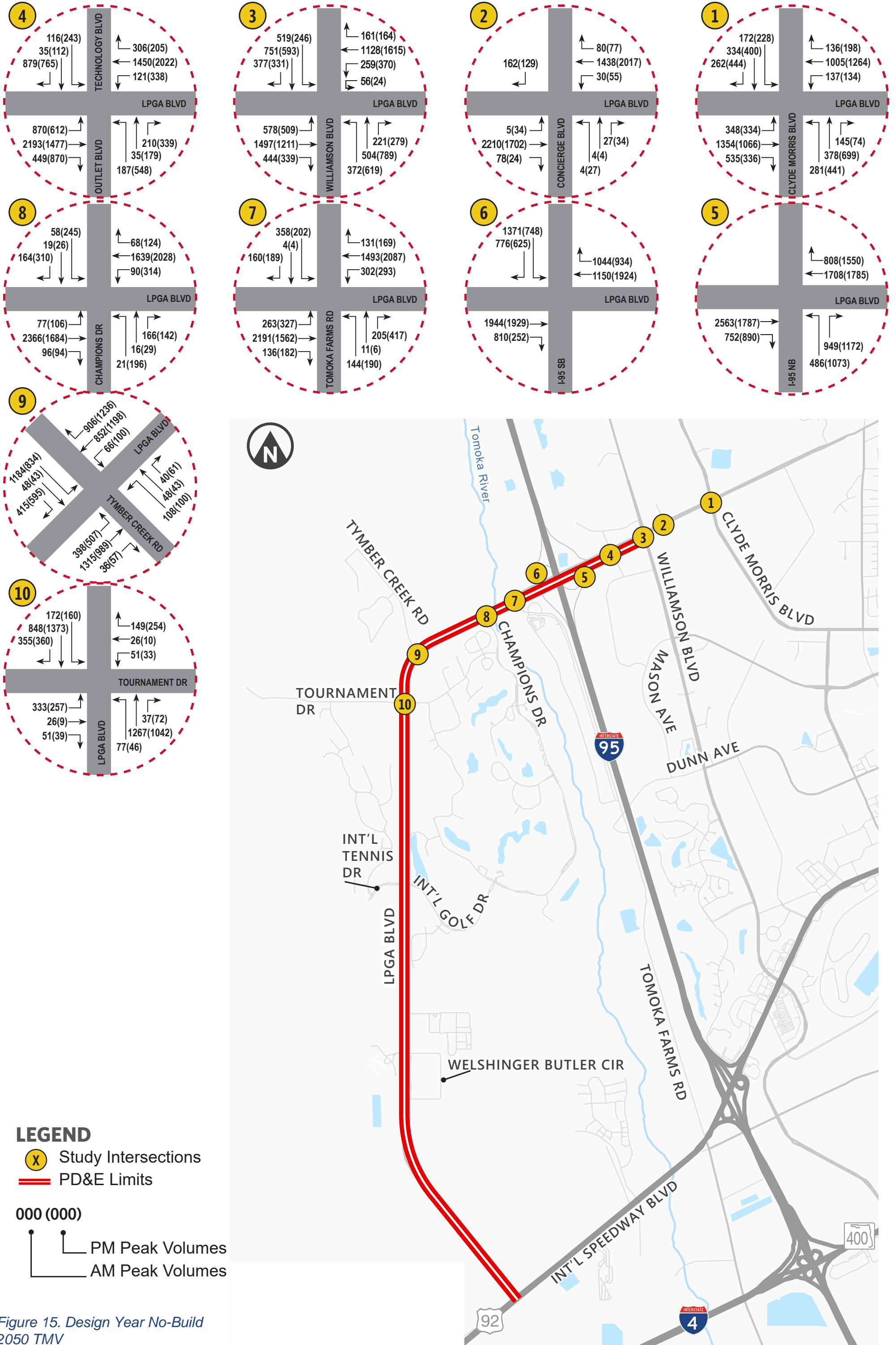
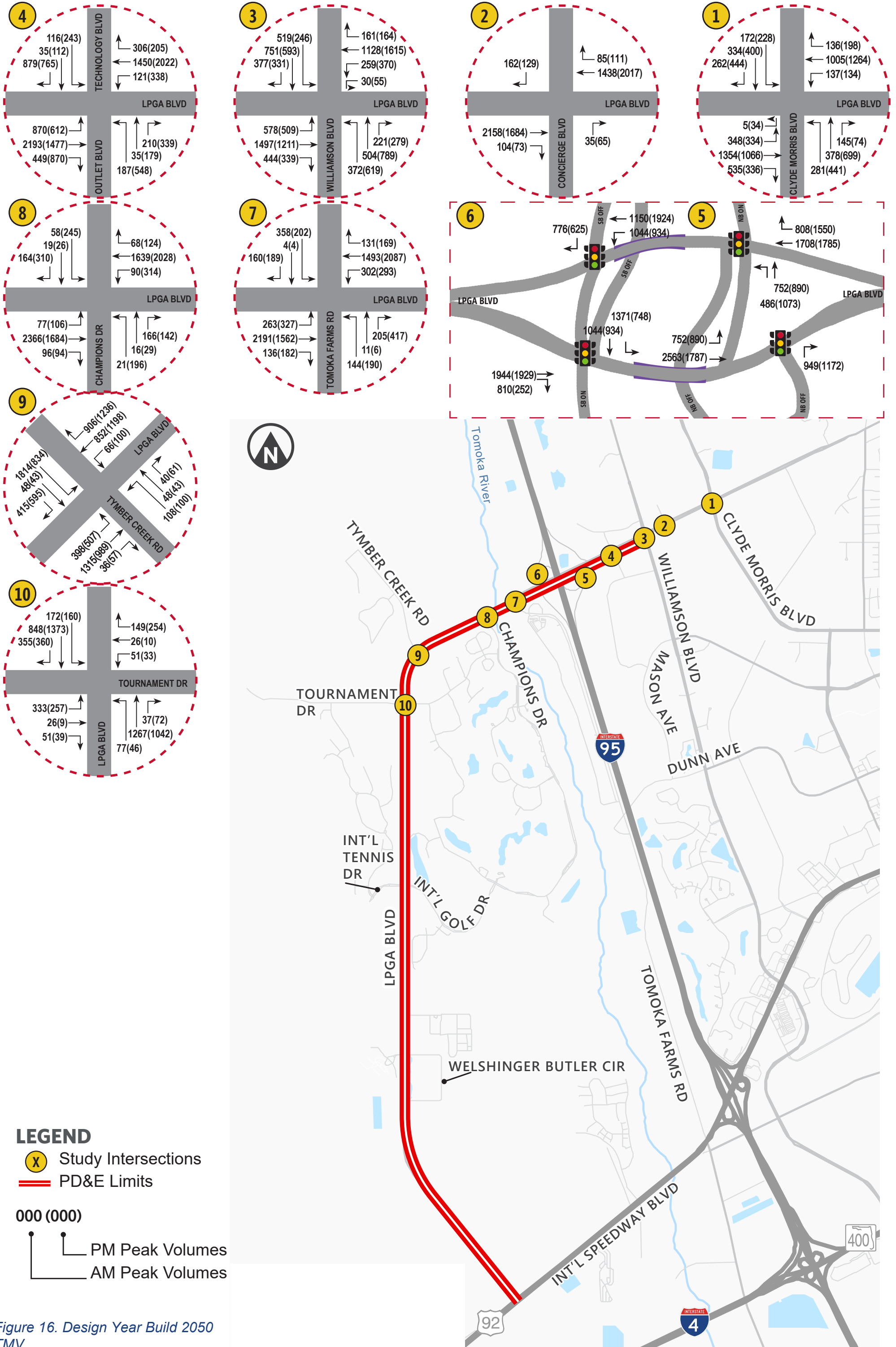


Figure 15. Design Year No-Build 2050 TMV

# LPGA Boulevard from U.S. 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report



# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 5.0 Considered Alternatives

Consistent with the approved MLOU, two alternatives were considered in this IMR:

- No-Build Alternative
- Build Alternative

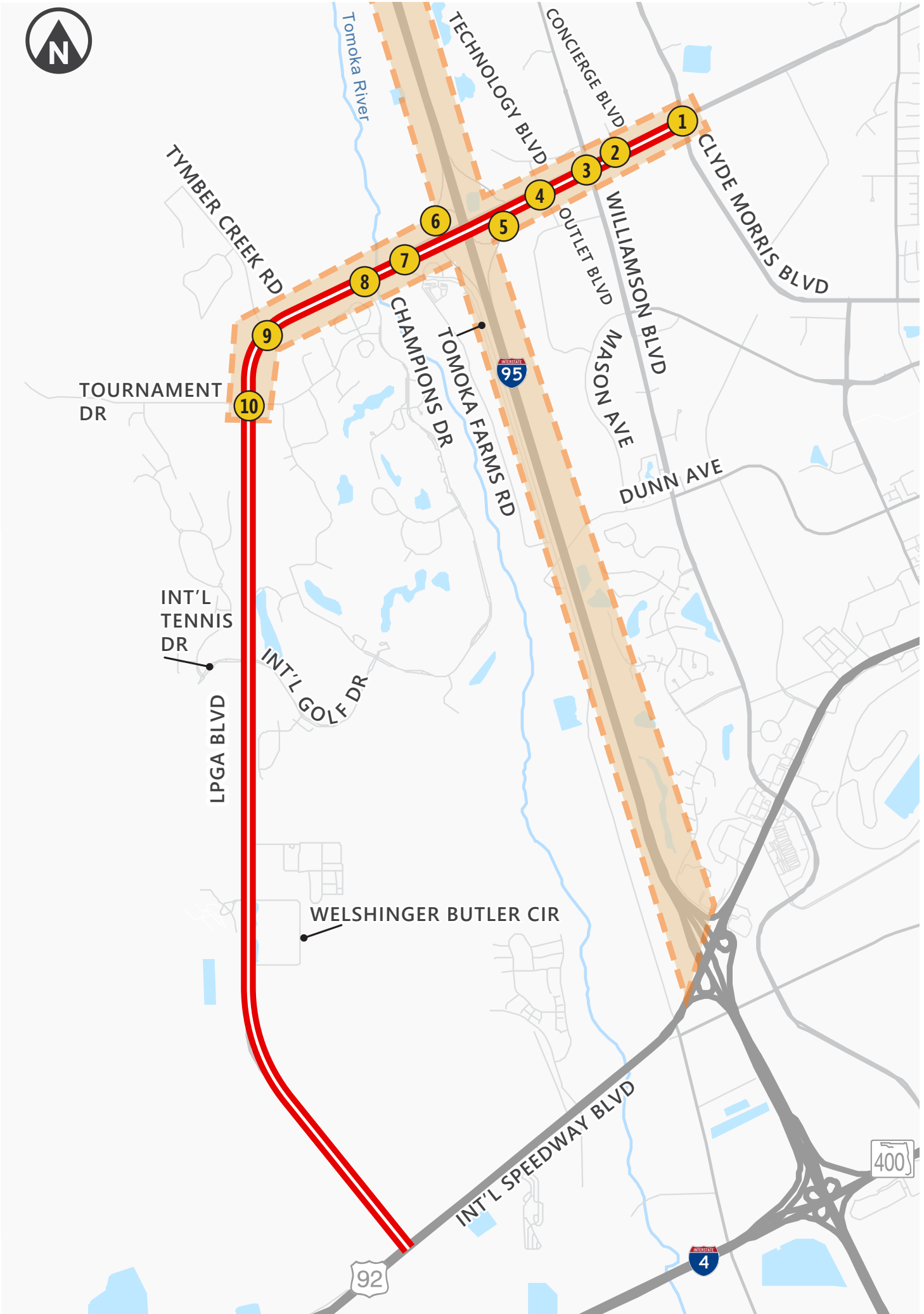
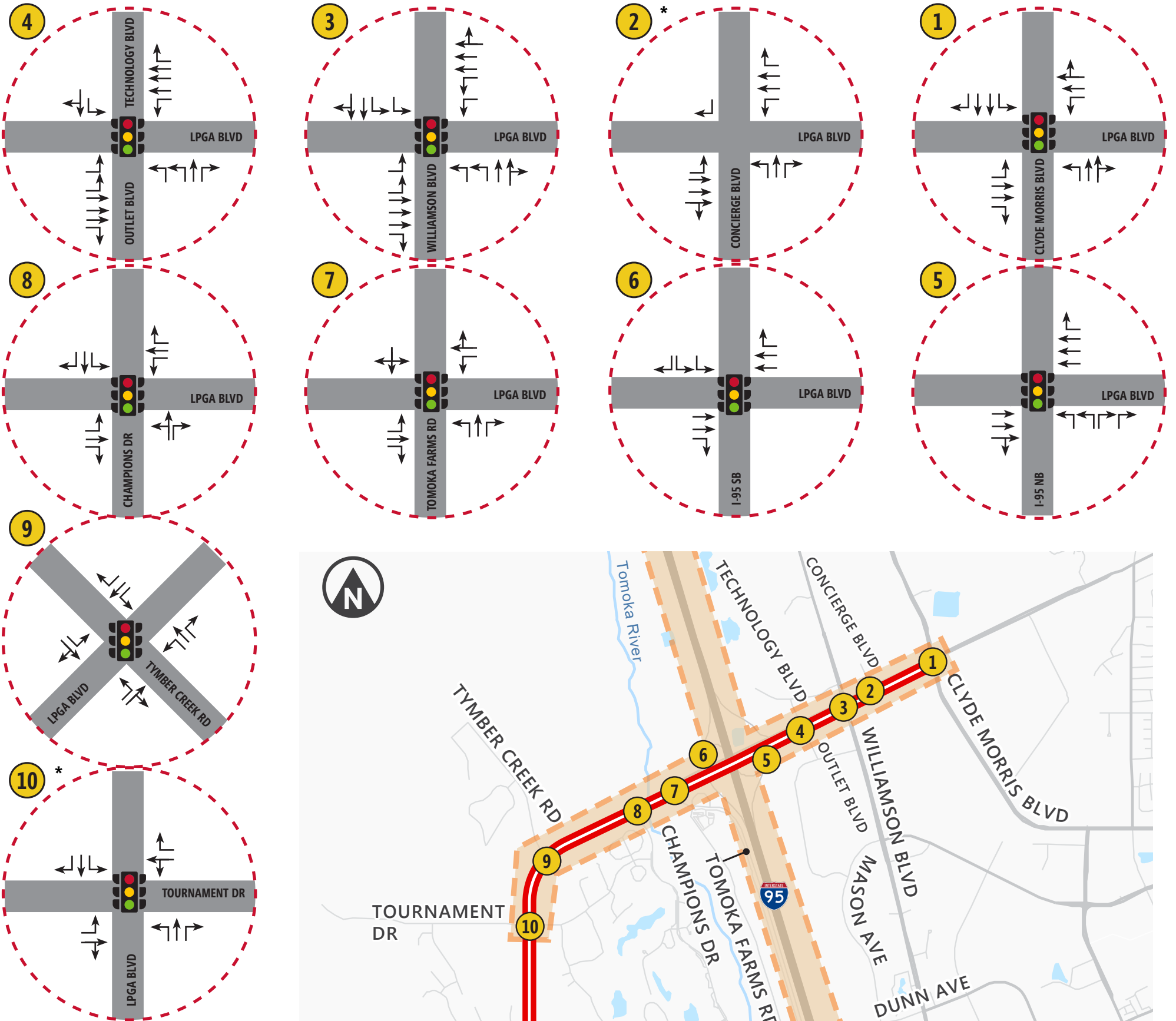
These alternatives are further discussed below.

#### 5.1 No-Build Alternative

The No-Build (no action) Alternative maintains the existing roadway and loop ramp interchange configuration for LPGA Boulevard. There are no planned and programmed improvements within the study limits. The only modified approach was adding a fourth leg to Tymber Creek Road to match the development site plan and ongoing (2022) construction. Other planned developments either do not have site plans or do not affect the No-Build geometry within the model limits and were therefore not included. The 2030 and 2050 No-Build Alternative lane configurations are shown in **Figure 17**.

#### 5.2 Transportation Systems Management and Operations

Transportation Systems Management and Operations (TSMO) strategies for safety and congestion management, such as addition of turn lanes and storage lengths, signal timing optimization, auxiliary lanes, premium transit, and technology improvements were considered. However, these improvements by themselves would not address the levels of traffic demand projected to use LPGA Boulevard and the I-95 interchange in the future. It is noted that ramp signals were identified and included in the Build Alternative. As part of design and operational optimization of the proposed improvements, applicable TSMO strategies will be evaluated and included in the Build Alternative during the Design phase.



### LEGEND

- X Study Intersections
- PD&E Limits
- IMR Area of Influence

\*Note: Configuration differs from PTFM. Configuration was updated between PTFM development and operational analysis.

Figure 17. No-Build Lane Configurations - 2030 and 2050

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 5.3 Development of Build Alternative

Development of build alternatives for this project followed a two-phase approach:

- Phase 1 – Concept Screening
- Phase 2 – Detailed Operational Analysis (IMR)

Phase 1 was the initial planning and environmental constraints mapping, traffic analysis, and preliminary alternative concept analysis to reach viable alternatives—the HCM refer to this analysis level as a planning analysis. The Phase 1 Alternatives Evaluation Technical Memorandum is in **Appendix B**. A detailed analysis was conducted in Phase 2 of the PD&E Study and the IMR process for the viable alternatives and no-build alternative. During Phase 1, various interchange concepts were evaluated through a high-level planning analysis which identified fatal flaws in any of the potential preliminary improvement concepts.

#### 5.3.1 Intersections

At the concept screening stage, several intersection control types were evaluated for each intersection within the AOI. Design Year 2050 TMVs and five-year crashes were used for this analysis. Based on the analysis and coordination with local agencies, the following intersection concepts were included in the Build Alternative. Innovative intersection concepts at Tomoka Farms Road and at Outlet Boulevard/Technology Boulevard were presented at the public meeting. However, public feedback leaned toward traditional intersection options as shown below:

- Tournament Drive – Signalized Intersection
- Tymber Creek Road – Signalized Intersection
- Tomoka Farms Road – Signalized Intersection
- Outlet Boulevard/Technology Boulevard – Signalized Intersection
- Williamson Boulevard – Signalized Intersection

#### 5.3.2 I-95 Interchange

The operation of the I-95 interchange is influenced by the proximity of the adjacent intersections which are located between Tournament Drive and Williamson Boulevard. In this segment, there are five signalized intersections within one mile of the interchange area. Major traffic flows head to and from I-95; most importantly, there is significant traffic volume between the I-95 ramp terminals and the Outlet Boulevard/Technology Boulevard intersection. The interchange area experiences unbalanced and heavy traffic movements from/to I-95 and Technology Boulevard, Outlet Boulevard, and Williamson Boulevard. Consequently, several interchange types and configurations were considered and dismissed from further consideration because of their inability to serve projected traffic volumes.

##### Considered Alternatives

The interchange control options that would provide better coordination of traffic along LPGA Boulevard are those which have a fewer number of signals and have two-phase signal operations at the ramp terminals. As a result, the following interchange configurations were

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

considered with respect to constructability and right-of-way needs, traffic operations, structure cost, and operational resilience (the ability of the concept to be further expanded in the event of additional traffic demand):

- Diverging Diamond Interchange (DDI)
- Signalized Turbine Interchange
- Grade Separated Modified Diamond
- Echelon Corridor
- Displaced Left Interchange Concept

After consideration of the future demand volumes, potential future growth in the LPGA Boulevard area, and coordination with District 5, a signalized turbine interchange concept was proposed to be evaluated in detail in Phase 2. This concept is a modified turbine interchange with two levels and its ramps are curved to connect along LPGA Boulevard with two-phase signals. It is a variant of a configuration that is common in system-to-system interchanges. This service interchange version is modified with lower speed movements and signal control at ramp terminal intersections. The other options were eliminated for the following reasons:

- Diverging Diamond Interchange (DDI) – cannot address traffic demand and project need
- Grade Separated Modified Diamond – numerous new structures and vertical profiles not conducive to heavy vehicles
- Echelon Corridor – cost prohibitive due to multiple bridge and elevated sections, inconsistent with land uses
- Displaced Left Interchange Concept – cannot address traffic demand and project need

### Selected Alternative for Detailed Analysis

The signalized turbine interchange concept spreads the traffic across westbound and eastbound LPGA Boulevard and, as a result, it moves high volumes and provides enough queue storage between signalized ramp terminals. This concept would provide better safety and operational benefits than the other concepts evaluated during the design year. Additionally, the signalized turbine interchange can more easily allow for expansion should future needs require.

The Phase 1 process and its outcome that recommended the signalized turbine interchange was presented to the District Interchange Review Coordination (DIRC) meeting on May 24, 2021.

**The Signalized Turbine Interchange concept was the selected Build Alternative.**

### Roadway Widening

The Build Alternative also includes roadway widening to support the interchange improvements as follows:

- US 92 to Tymber Creek Road – Widen LPGA Boulevard from two lanes to four lanes
- Tymber Creek Road to I-95 – Widen LPGA Boulevard from two lanes to six lanes
- I-95 to Concierge Boulevard – Widen LPGA Boulevard from four lanes to between six and eight lanes

## LPGA Boulevard from US 92 to Williamson Boulevard PD&amp;E Study

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In addition to the interchange and roadway widening, the side streets of Tymber Creek Road, Tomoka Farms Road, Outlet Boulevard, and Williamson Boulevard were modified to facilitate Design Year 2050 traffic flow to and from LPGA Boulevard. The intersection at Concierge Boulevard was modified to be a right-in, right-out for safety and operational purposes. The intersection at Clyde Morris Boulevard was not modified since it is outside of the PD&E limits.

#### Ramp Signals

Upon modeling the Build Alternative, congestion on I-95 southbound near the US 92/I-4 diverge area, south of the PD&E study limits, was identified. This is discussed further in *Section 6.3*. To manage the congestion, a ramp signal was placed and analyzed for the southbound on-ramp to meter the traffic demand. The northbound on-ramp did not show a need for ramp signal under normal operating conditions by Design Year 2050 given the free-flow conditions on I-95 and was not included in the operational models. However, the proposed northbound on-ramp extends approximately 2,000-feet from the interchange ramp terminal to the freeway gore point, which provides the AASHTO minimum acceleration distance and the remaining distance as queue storage to facilitate ramp signal operation for incident management.

#### Build Alternative Concept

The signalized turbine Build Alternative concept plan is shown in **Figure 18**. The 2030 and 2050 lane configurations for the Build Alternative are shown in **Figure 19**.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study Interchange Modification Report

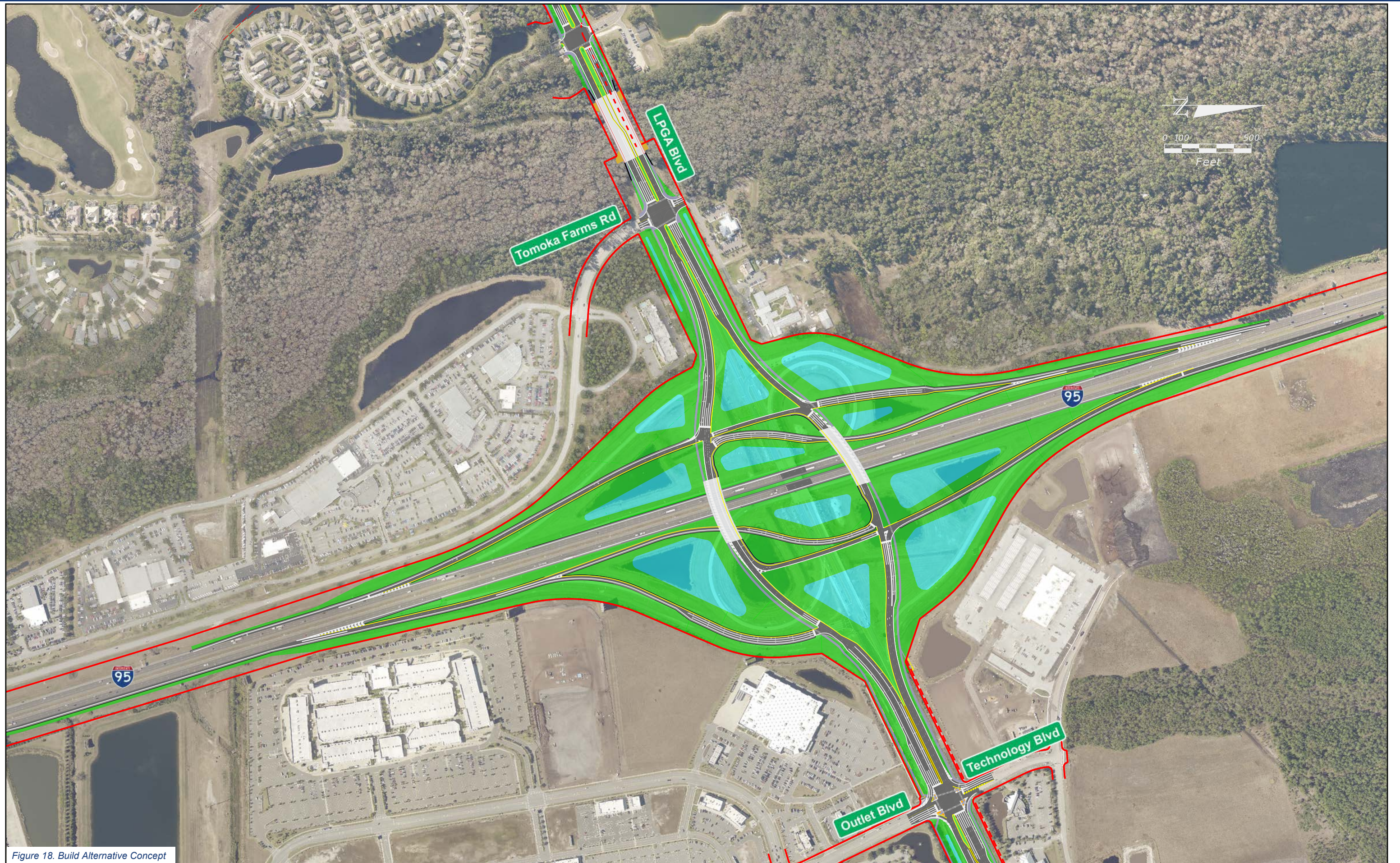
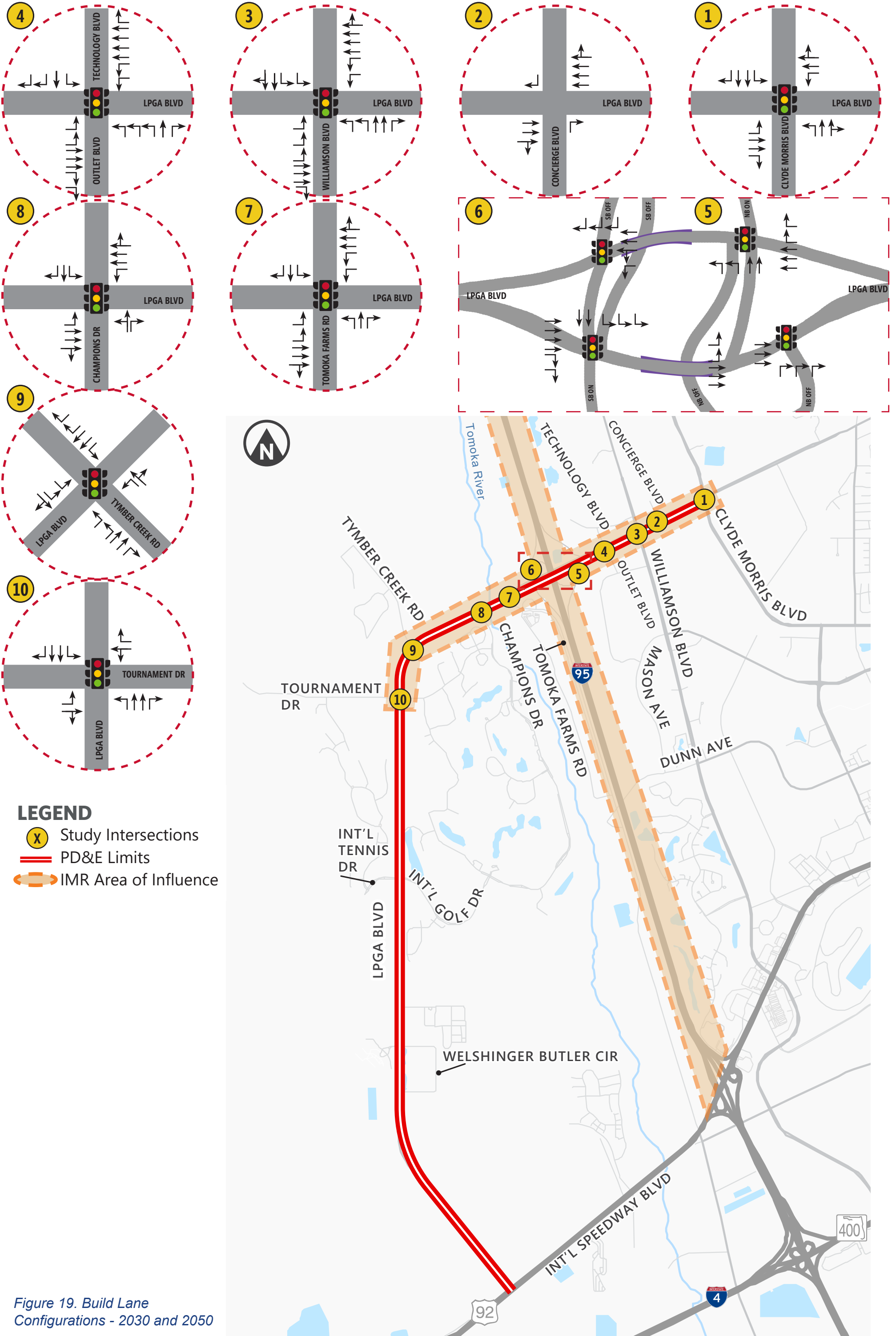


Figure 18. Build Alternative Concept

## Interchange Modification Report



# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

## 6.0 Future Traffic Operation Analysis

The section documents the No-Build and Build analyses for Opening Year 2030 and Design Year 2050.

### 6.1 Vissim Model Development and Geometry

The calibrated Existing Year 2021 models were used to develop the future year models. All calibration parameters such as speed distributions and driver behavior were carried forward. The Vissim vehicle inputs and routing followed the same procedure described in *Section 3.2.2*. However, the StreetLight OD matrix was not used as a base matrix given that traffic patterns are expected to change significantly with the new development patterns expected in the LPGA Boulevard area.

Traffic signals were optimized in Synchro for both No-Build and Build. Optimization included coordination and optimization for cycle length, splits, and offsets. Manual adjustments were made to the default Synchro optimization to strive for volume-to-capacity (V/C) ratios less than 1.0, queues within storage bays, and improved signal progression in Vissim.

Pedestrian crossing times were calculated for the major and minor street movements at each analysis intersection. Pedestrian crossing times were covered for the LPGA Boulevard mainline signal phases. They were not covered for the minor street signal phases given that pedestrian calls are not expected every cycle.

#### No-Build Model

The No-Build geometry was nearly identical to the Existing model. Given the increased traffic demand, the following changes were made to reflect future congestion:

- New priority rules were added to the No-Build model to mitigate vehicles blocking intersections and unrealistically driving over one another. The No-Build 2030 network was identical to No-Build 2050.

#### Build Model

The Build model geometry was adjusted to match the proposed Build Alternative, including a ramp signal for the southbound on-ramp. This was included to manage demand, as discussed with District 5.

Given the new interchange configuration with dual lane ramps and increased traffic flow, the following network changes were made:

- Lane change distances per lane at diverge locations were updated from 2,500-feet to 10,000-feet for through movement and 5,000-feet for exit ramp movements.
- Lane change distances for the dual lane exit ramp split to LPGA Boulevard westbound and LPGA Boulevard eastbound were updated from 2,500-feet to the maximum distance to the upstream diverge.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 6.2 Network Performance

#### Opening Year 2030

Performance measures for No-Build and Build in Opening Year 2030 are summarized in **Table 11**. The No-Build model experiences traffic gridlock (with average speeds below 5 mph) due to:

- Lack of capacity on LPGA Boulevard. The two-lane section west of I-95 gridlocks the entire network, including the I-95 mainline.
- The LPGA Boulevard exit ramp demand cannot be processed by the ramp terminal signal, specifically in the westbound direction, where LPGA Boulevard is only two lanes. the large magnitude of traffic growth in the area.

Table 11. Network Performance – Opening Year 2030

Parameter	Opening Year 2030					
	No-Build	Build	% Imp	No-Build	Build	% Imp
	Hour 1 (6:30 AM - 7:30 AM)			Hour 1 (3:45 PM - 4:45PM)		
Total Travel Time (hr)	870	841	3%	4,737	1,556	67%
Total Delay (hr)	229	168	27%	4,245	405	90%
Average Delay (s/veh)	78	57	27%	1,161	76	93%
Latent Demand (veh)	10	0	100%	6,762	0	100%
Average Speed (mph)	46	48	4%	7	44	529%
	Hour 2 (7:30 AM - 8:30 AM)			Hour 2 (4:45 PM – 5:45 PM)		
Total Travel Time (hr)	2,320	1,413	39%	7,851	1,605	80%
Total Delay (hr)	1,451	334	77%	7,712	426	94%
Average Delay (s/veh)	321	70	78%	2,680	78	97%
Latent Demand (veh)	1,028	4	100%	21,585	1	100%
Average Speed (mph)	24	46	92%	1	43	4200%
	Hour 3 (8:30 AM - 9:30 AM)			Hour 3 (5:45 PM – 6:45 PM)		
Total Travel Time (hr)	3,950	1,356	66%	7,893	1,196	85%
Total Delay (hr)	3,253	368	89%	7,722	268	97%
Average Delay (s/veh)	787	84	89%	2,574	64	98%
Latent Demand (veh)	4,358	346	92%	32,300	0	100%
Average Speed (mph)	11	44	300%	1	46	4500%

The Build Alternative can handle the traffic well—this is supported by high percentages of improved travel times, reduced delays, and low amounts of latent demand shown in **Table 11**. In the third hour of the 2030 AM Build model, the latent demand of 346 vehicles is due to demand metering and queue spillback southbound Tymber Creek Road (minor street), which is expected to have new mixed-use developments built by the Opening Year 2030. Through coordination with Volusia County and the City of Daytona Beach, these developments would be responsible for any minor street improvements. The LPGA Boulevard widening is designed so it can receive additional minor street turn lanes.

Network speed maps presented in **Figure 20** through **Figure 23** show significant improved speeds in the Build Alternative when compared to the No Build Alternative.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

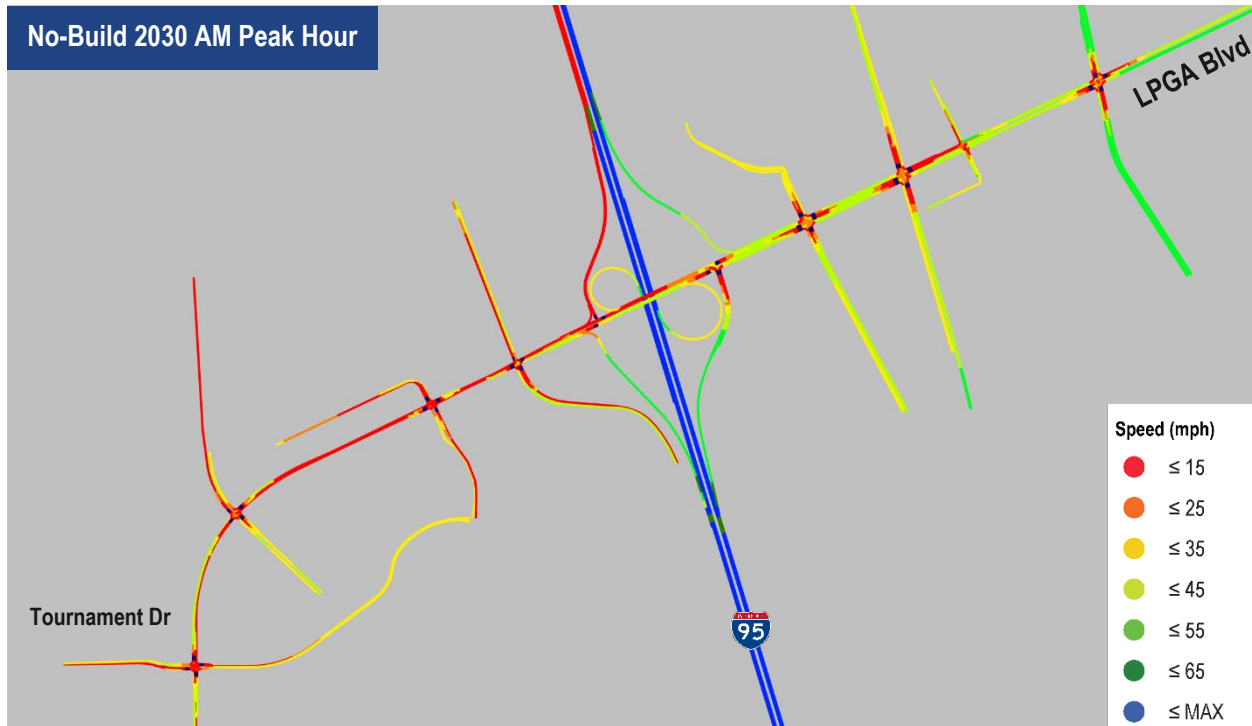


Figure 20. Network Performance Map – No-Build 2030 AM

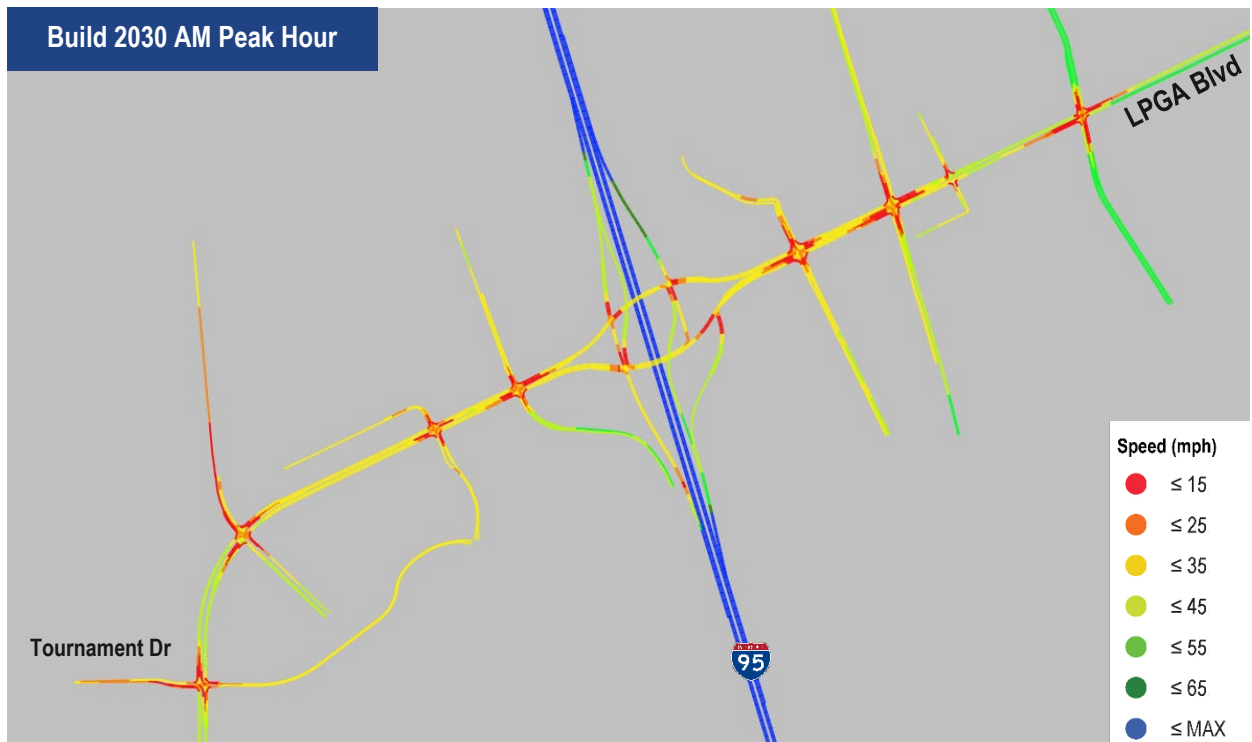


Figure 21. Network Performance Map – Build 2030 AM

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

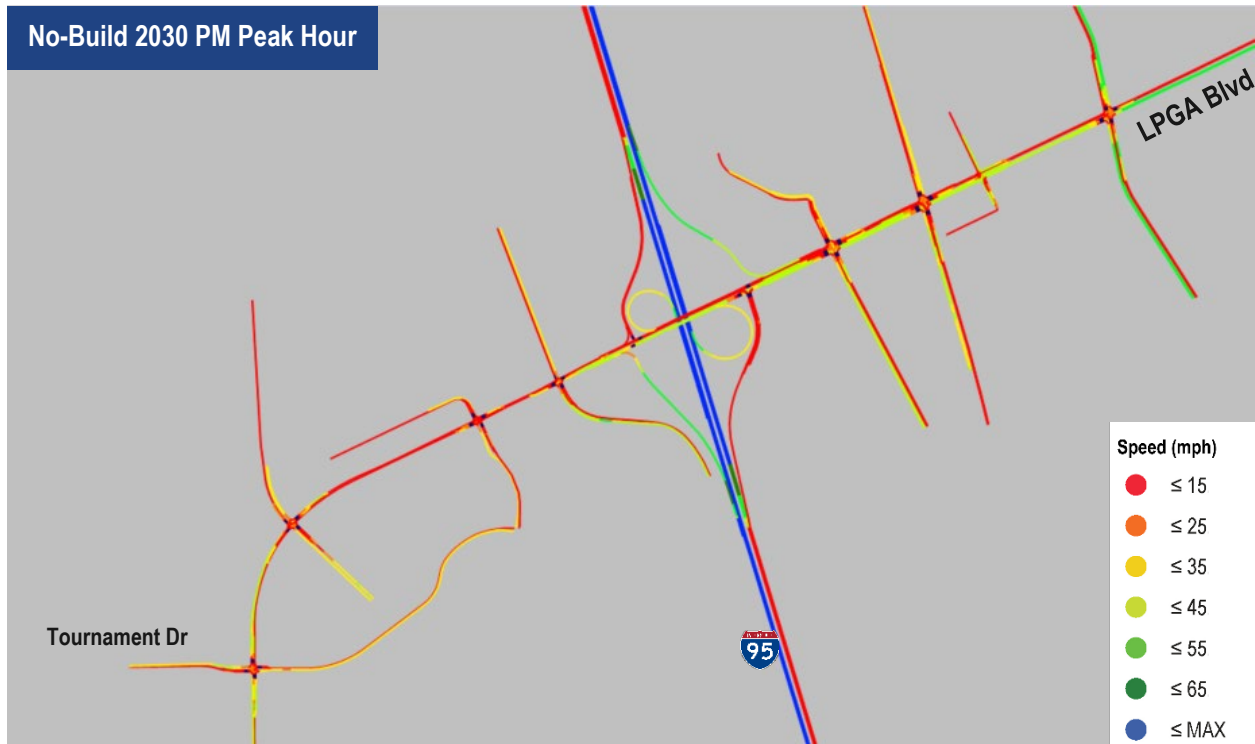


Figure 22. Network Performance Map – No-Build 2030 PM

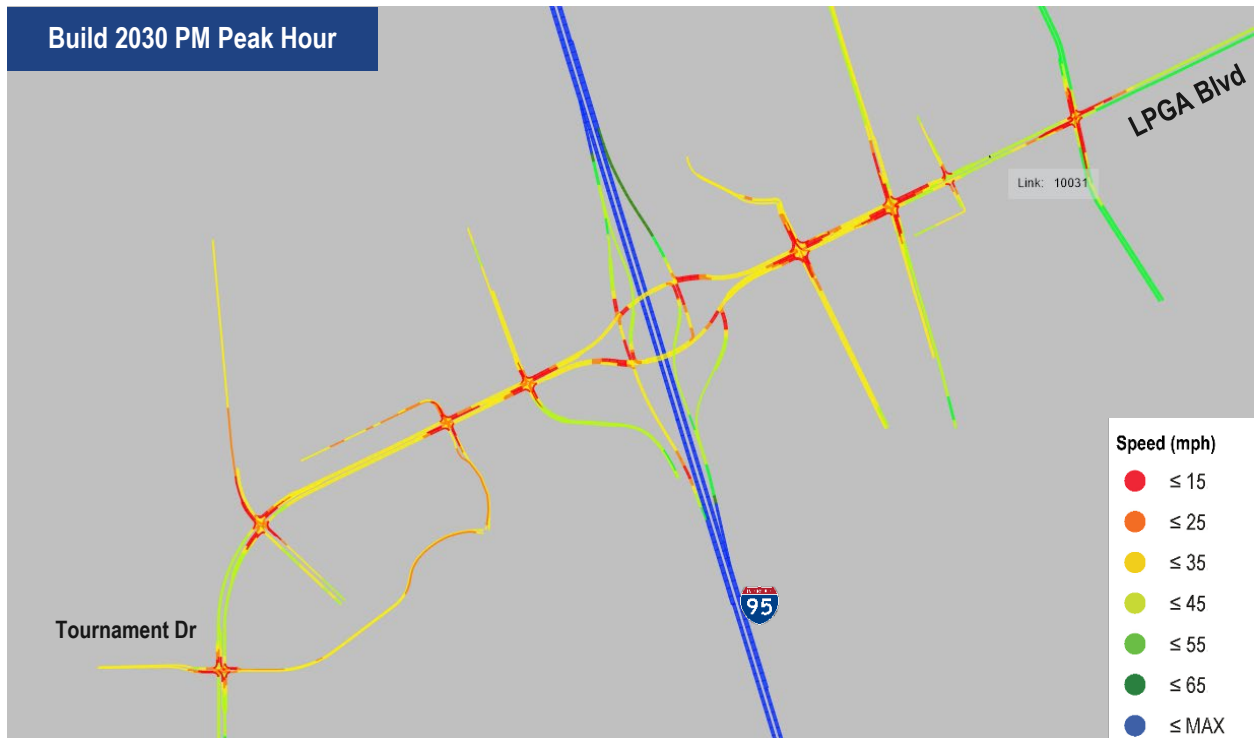


Figure 23. Network Performance Map – Build 2030 PM

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### Design Year 2050

Performance measures for No-Build and Build in Design Year 2050 are in **Table 12** and in the network speed maps presented in **Figure 24** through **Figure 27**. The No-Build model is highly congested due to:

- Capacity constraints along LPGA Boulevard—the demand to use LPGA Boulevard far exceed the capacity. The two-lane section west of I-95 gridlocks the entire network, including the I-95 mainline.
- The LPGA Boulevard interchange single lane exit ramps cannot handle the 2050 volumes. Both exit ramps exceed 2,100 vehicles per hour in both the AM and PM peak.
- The LPGA Boulevard exit ramp demand cannot be processed by the ramp terminal intersection signals, specifically in the westbound direction, where LPGA Boulevard is only two lanes.

The Build Alternative alleviates the congestion by expanding roadway capacity and increasing the efficiency of the interchange operation. The Build Alternative uses a series of two-phase signals to improve traffic progression and reduce delay. Additionally, it uses a combination of left-hand and right-hand turn lanes (from LPGA Boulevard) to I-95 to allow for more even lane utilization on LPGA Boulevard through the interchange area. The No-Build loop ramp concept uses only right-hand exits which would result in vehicles stacking in the outside approach lanes. The latent demand in the Build Alternative is due to factors outside of the PD&E scope:

- The I-95 northbound US 92/I-4 CD merge area located approximately 8,000-feet south of the LPGA Boulevard diverge.
- The I-95 southbound US 92/I-4 CD diverge which have two lanes with the second lane starting about 1,500-feet prior to the diverge point – the collector-distributor (CD) system peak hour volumes, range between approximately 2,700 vph and 3,200 vph, cannot be handled by the existing diverge configuration and a speed breakdown occurs due to the constrained capacity.
- Capacity constraints on the side streets, particularly southbound Tymber Creek Road, southbound Tomoka Farms Road, and southbound Williamson Boulevard.

Despite the low amount of latent demand observed, LPGA Boulevard in the Build Alternative as a six to eight lane facility has excess capacity to absorb additional traffic if future improvements are made to the side streets.

Overall, the Build Alternative shows significant improvements over the grid-locked No-Build Alternative, with a 77% reduction in total delay during the 2050 AM peak hour and a 78% reduction in delay during the 2050 PM peak hour.

Comparison of the network speed maps presented in **Figure 24** through **Figure 27** show significant improvements in speeds in the Build Alternative when compared to the No Build Alternative. It is noted that the Build Alternative southbound on ramp shows lower speeds at the ramp junction along I-95, which is expected as the ramp signal will be activated, and the vehicles will queue up on the ramp before being released into I-95 mainlines.

## LPGA Boulevard from US 92 to Williamson Boulevard PD&amp;E Study

## Interchange Modification Report

Table 12. Network Performance – Design Year 2050

Parameter	Design Year 2050					
	No-Build	Build	% Imp	No-Build	Build	% Imp
	Hour 1 (6:30 AM - 7:30 AM)			Hour 1 (3:45 PM - 4:45PM)		
Total Travel Time (hr)	1,551	1,286	17%	7,013	2,574	63%
Total Delay (hr)	743	347	53%	6,769	1,083	84%
Average Delay (s/veh)	188	82	56%	2,132	150	93%
Latent Demand (veh)	1,237	184	85%	18,996	1,408	93%
Average Speed (mph)	33	43	30%	2	34	1600%
	Hour 2 (7:30 AM - 8:30 AM)			Hour 2 (4:45 PM – 5:45 PM)		
Total Travel Time (hr)	4,666	2,353	50%	8,021	3,248	60%
Total Delay (hr)	3,857	899	77%	7,900	1,706	78%
Average Delay (s/veh)	757	136	82%	2,763	227	92%
Latent Demand (veh)	8,785	1,471	83%	42,049	2,552	94%
Average Speed (mph)	11	37	236%	1	28	2700%
	Hour 3 (8:30 AM - 9:30 AM)			Hour 3 (5:45 PM – 6:45 PM)		
Total Travel Time (hr)	6,202	2,277	63%	7,956	2,675	66%
Total Delay (hr)	5,514	935	83%	7,818	1,329	83%
Average Delay (s/veh)	1,149	151	87%	2,699	207	92%
Latent Demand (veh)	19,129	3,458	82%	58,667	1,953	97%
Average Speed (mph)	7	35	400%	1	29	2800%

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study Interchange Modification Report

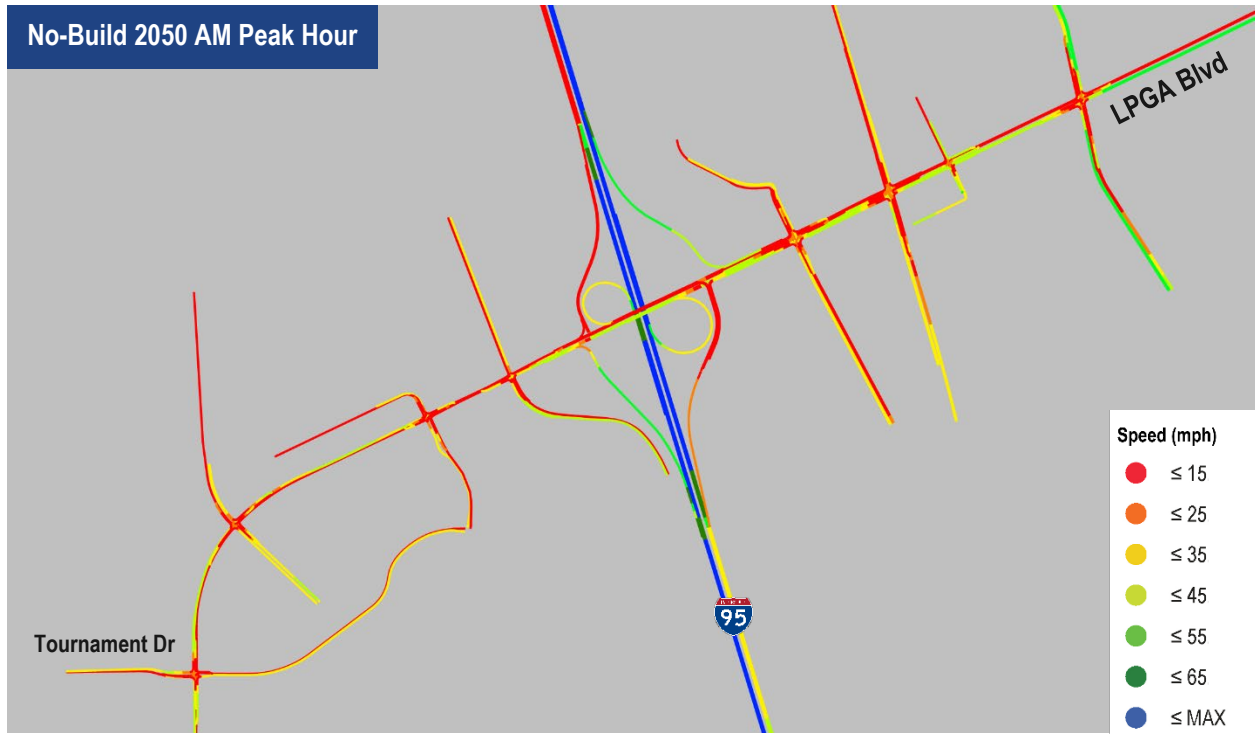


Figure 24. Network Performance Map – No-Build 2050 AM

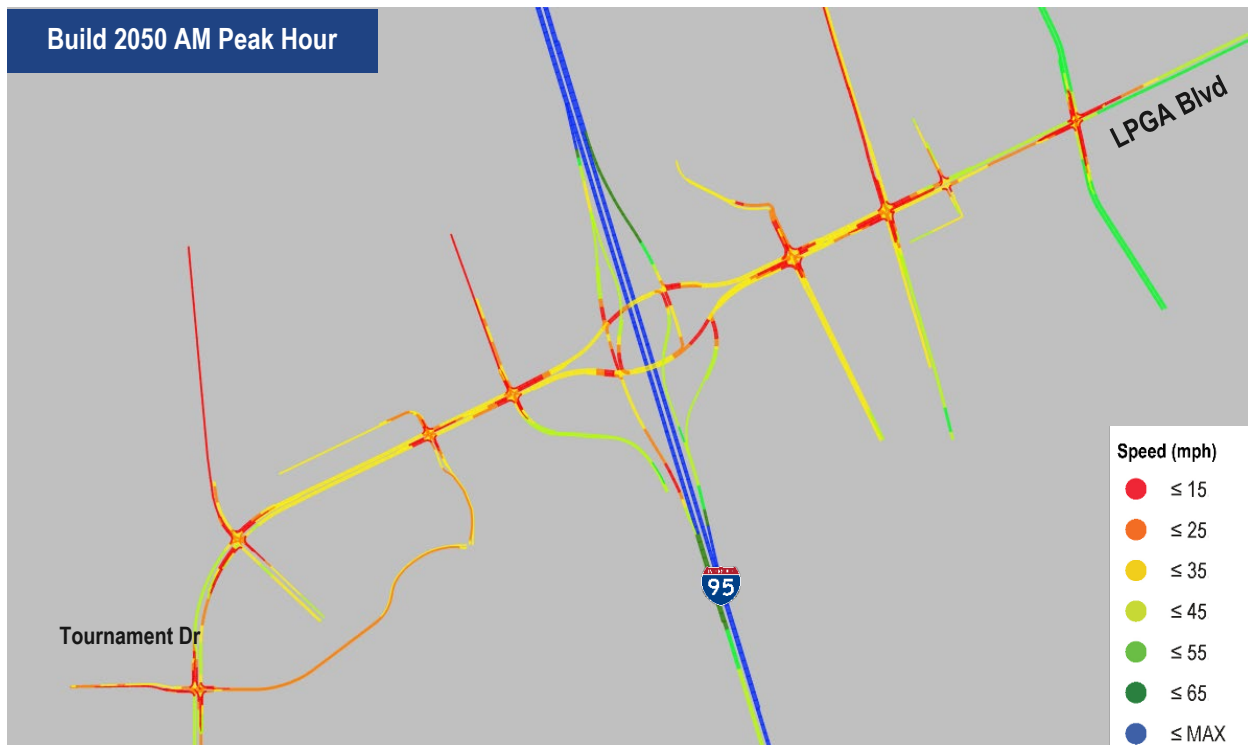


Figure 25. Network Performance Map – Build 2050 AM

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

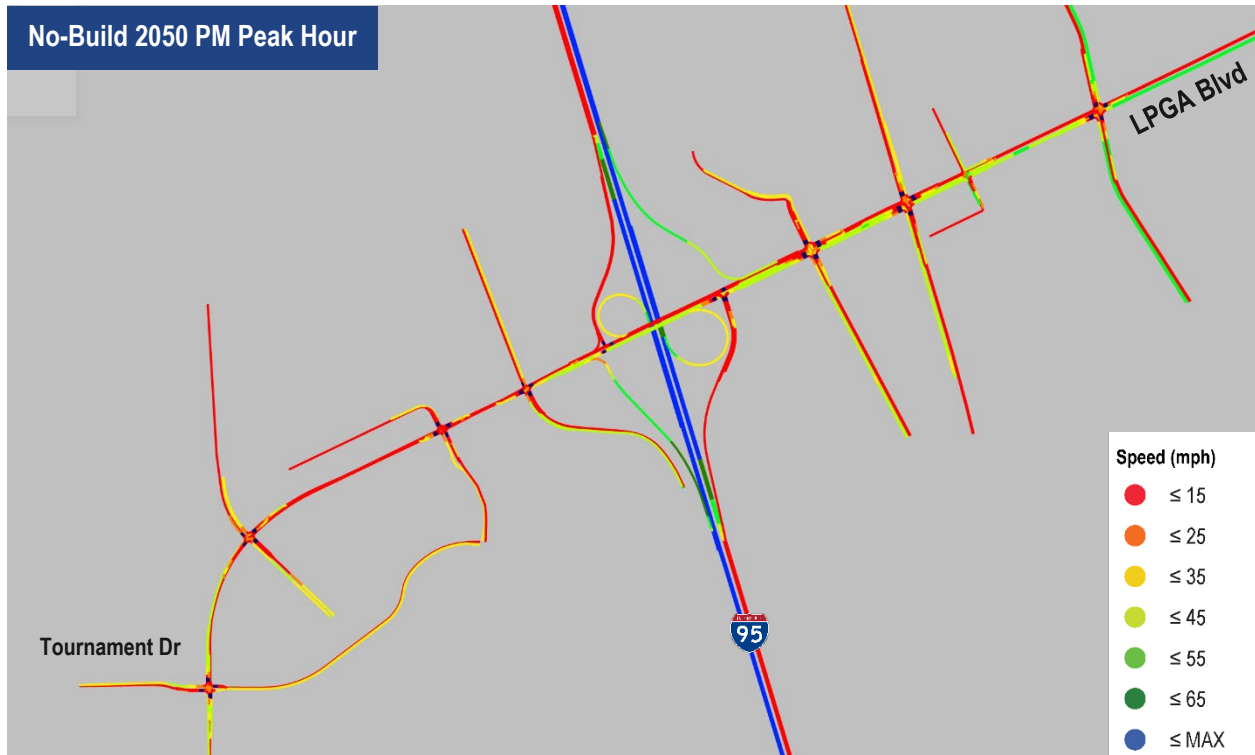


Figure 26. Network Performance Map – No-Build 2050 PM



Figure 27. Network Performance Map – Build 2050 PM

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

## Interchange Modification Report

### 6.3 I-95 Mainline Operations

#### Opening Year 2030

The demand and the simulated volumes (throughput) summarized in **Table 13** show considerable amount of latent demand along I-95 segments under No-Build conditions. The No-Build simulated volumes (throughput), especially in the southbound direction, are much lower than the Opening Year 2030 demand due to the LPGA Boulevard ramp terminal intersection queues blocking vehicles turning to and from the I-95 mainlines.

Opening Year 2030 volume and speed profiles for the No-Build Alternative summarized in **Figure 28, Figure 30, Figure 32, and Figure 34** show the extent of congestion in the network where speed drops occur in the following segments:

- I-95 southbound between SR 40 on-ramp and LPGA Boulevard off-ramp in the PM peak period and I-95 northbound between US 92/I-4 merge area, and
- LPGA Boulevard off-ramp in both peak periods

These observations are supported by the estimated freeway LOS shown in **Table 14** which show failing conditions (LOS F) in both segments.

In the Build Opening Year 2030, the simulated volumes (throughput) are comparable to the Opening Year 2030 demand indicating that the improvements in the Build Alternative have eliminated the traffic bottlenecks.

Opening Year 2030 volume and speed profiles for the Build Alternative summarized in **Figure 29, Figure 31, Figure 33, and Figure 35** show the congestion in the network has dissipated. Travel speeds are approximately 60 mph or above along all I-95 segments. However as shown in **Table 13**, there is noticeable latent demand near the US 92/I-4 CD system which has limited capacity. The I-95 southbound segment between LPGA Boulevard on-ramp and the US 92/I-4 CD system experiences only moderate speed drops. The speed drops are only confined to the CD system diverge areas. However, the estimated LOS for the freeway segments (as shown in **Table 14**) is C or better.

### Design Year 2050

Analysis of the volume and speed profiles presented in **Figure 36**, **Figure 38**, **Figure 40**, and **Figure 42** show that in the Design Year 2050, the No-Build Alternative will experience very low speeds that will create substantial traffic gridlock in throughout the network due to the ramp terminal intersections queuing back to the mainline and blocking through traffic. Segments with higher speeds (example between I-95 on-ramp and US 92/I-4 CD system in **Figure 40**) have lower throughput because the measured volume is queue discharge flow which is always less than the demand. As shown in **Table 13**, the amount of latent demand along I-95 segments under No-Build Alternative is very large which can confirm the gridlock operating conditions.

Estimated Design Year 2050 No-Build Alternative LOS, presented in **Table 15**, show that the freeway segment upstream of the I-95/LPGA interchange operate at failing conditions (LOS F) due to congestion along LPGA Boulevard while the segments downstream of the interchange operate at LOS C or better because of queue discharge flow.

In the Design Year 2050 Build Alternative, the simulated volumes (throughput) are comparable to the Design Year 2050 demand, indicating that the improvements in the Build Alternative have eliminated the traffic bottlenecks. As discussed in the Network Performance Analysis (Section 6.2), the latent demand shown in **Table 13** is largely contributed to the network segments that are outside the limits of the PD&E Study such as the side streets and the US 92/I-4 CD system merge/diverge areas.

Design Year 2050 Build Alternative volume and speed profiles, summarized in **Figure 37**, **Figure 39**, **Figure 41**, and **Figure 43**, show the congestion in the network has mostly dissipated in all segments of I-95 mainline, except the segment between LPGA Boulevard on-ramp and US 92/I-4 CD system diverge which showed speed as low as 30 mph. Estimated LOS presented in **Table 15** show that the segment between LPGA Boulevard on-ramp and US 92/I-4 CD system section operates at LOS E due to capacity limitation of the CD system which is outside the limits of this project.

FDOT is aware of the bottleneck at the US 92/I-4 CD system which will be active between 2045 and 2050. The CD system currently has two exit/entrance ramp lanes. However, in the southbound direction, the second lane only starts about 1,500-feet prior to the diverge point – the CD system peak hour volumes, which range between approximately 2,700 vph and 3,200 vph, cannot be handled by the existing diverge configuration and speed breakdowns occur due to the constrained capacity. In the northbound direction, the two lanes on the CD system merge to a single lane to tie into the three-lane section of the I-95 northbound and create a bottleneck condition. FDOT will study potential improvements to fix capacity issues for this CD system under the I-95 strategic plan effort (master plan study) which will identify short-term and long-term capacity, operational and safety improvements along the corridor. The purpose of the I-95 strategic plan is to develop a long-term shared vision with the members of the communities and local stakeholders along the corridor.

# LPGA Boulevard from US 92 to Williamson Boulevard PD&E Study

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Table 13. I-95 Demand and Simulated Volumes – Opening Year 2030 and Design Year 2050

Alt	I-95 Segments	Segment Properties			Opening Year 2030				Design Year 2050			
		Dist <sup>1</sup> (mi)	Lanes	Type <sup>2</sup>	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
					Demand (vph)	Simulated (vph)	Demand (vph)	Simulated (vph)	Demand (vph)	Simulated (vph)	Demand (vph)	Simulated (vph)
<b>I-95 Southbound – No-Build</b>												
I-95 SB No-Build	Begin Study Area, North of SR 40 On-Ramp	0.5	3	Basic	2,808	2,726	3,056	467	3,345	1,308	4,097	441
	SR 40 On-Ramp	0.25	4	Basic	4,197	3,726	4,266	530	5,295	1,534	5,827	536
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	4,197	3,120	4,266	513	5,295	1,026	5,827	557
	LPGA Blvd Off-Ramp	0.25	4	Diverge	4,197	2,516	4,266	496	5,295	742	5,827	580
	From LPGA Blvd Off-Ramp to WB LPGA Blvd On-Ramp	0.5	3	Basic	2,704	1,787	3,273	304	3,148	386	4,454	417
	WB LPGA Blvd On-Ramp	0.25	4	Merge	3,301	2,360	4,124	352	4,192	995	5,388	454
	From WB LPGA Blvd On-Ramp to EB LPGA Blvd On-Ramp	0.25	3	Basic	3,301	2,367	4,124	353	4,192	1,001	5,388	452
	EB LPGA Blvd On-Ramp	0	4	Merge	3,610	2,535	4,275	398	5,002	1,237	5,640	484
	EB LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2	3	Basic	3,610	2,562	4,275	405	5,002	1,272	5,640	483
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	3,610	2,589	4,275	408	5,002	1,302	5,640	484
End Study Area, South of US 92/I-4 CD Off-Ramp	0.5	3	Basic	1,334	957	2,357	230	1,816	474	2,929	252	
<b>I-95 Southbound – Build</b>												
I-95 SB Build	Begin Study Area, North of SR 40 On-Ramp	0.5	3	Basic	2,808	2,798	3,056	3,057	3,345	3,334	4,097	4,098
	SR 40 On-Ramp	0.25	4	Basic	4,197	4,177	4,266	4,266	5,295	5,271	5,827	5,825
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	4,197	4,160	4,266	4,263	5,295	5,250	5,827	5,820
	LPGA Blvd Off-Ramp	0.25	4	Diverge	4,197	4,141	4,266	4,260	5,295	5,227	5,827	5,814
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	1	3	Basic	2,704	2,655	3,273	3,270	3,148	3,094	4,454	4,456
	LPGA Blvd On-Ramp	0.25	4	Merge	3,610	3,532	4,275	4,276	5,002	4,732	5,640	5,564
	From LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2	3	Basic	3,610	3,518	4,275	4,276	5,002	4,517	5,640	5,518
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	3,610	3,501	4,275	4,278	5,002	4,383	5,640	5,489
	End Study Area, South of US 92/I-4 CD Off-Ramp	0.5	3	Basic	1,334	1,293	2,357	2,350	1,816	1,601	2,929	2,848
	<b>I-95 Northbound – No-Build</b>											
I-95 NB No-Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	2,243	2,237	1,654	425	2,929	2,919	1,815	261
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	4	Merge	4,161	4,135	3,930	501	5,640	5,417	5,001	329
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	4,161	4,129	3,930	470	5,640	5,300	5,001	305
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.5	4	Basic	4,161	4,113	3,930	442	5,640	5,055	5,001	279
	From LPGA Blvd Off-Ramp to LPGA Blvd EB On-Ramp	0.25	3	Diverge	4,161	4,094	3,930	444	5,640	4,865	5,001	272
	LPGA Blvd EB On-Ramp	0.5	4	Basic	3,446	3,009	3,181	273	4,957	3,643	3,646	122
	LPGA Blvd EB On-Ramp to LPGA Blvd WB On-Ramp	0.25	3	Merge	3,446	3,208	3,181	399	4,957	3,867	3,646	228
	LPGA Blvd WB On-Ramp	0.25	4	Basic	3,446	3,205	3,181	399	4,957	3,868	3,646	228
	From LPGA Blvd WB On-Ramp to SR 40 Off-Ramp	0.25	3	Merge	3,992	3,735	4,356	459	5,765	4,360	5,196	300
	SR 40 Off-Ramp	1.25	4	Basic	3,992	3,726	4,356	455	5,765	4,376	5,196	299
End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	3,992	3,713	4,356	450	5,765	4,383	5,196	298	
<b>I-95 Northbound – Build</b>												
I-95 NB Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	2,243	2,237	1,654	1,649	2,929	2,920	1,815	1,809
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	5	Merge	4,161	4,135	3,930	3,923	5,640	5,593	5,001	4,993
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	4,161	4,129	3,930	3,918	5,640	5,568	5,001	4,984
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.5	3	Basic	4,161	4,113	3,930	3,916	5,640	5,533	5,001	4,979
	LPGA Blvd Off-Ramp	0.25	4	Diverge	4,161	4,094	3,930	3,909	5,640	5,505	5,001	4,964
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	0.75	3	Basic	3,061	3,009	2,701	2,695	4,205	4,101	2,756	2,720
	LPGA Blvd On-Ramp	0.25	5	Merge	3,992	3,208	4,356	4,340	5,765	5,477	5,196	4,964
	From LPGA Blvd On-Ramp to SR 40 Off-Ramp	1.25	4	Basic	3,992	3,205	4,356	4,340	5,765	5,466	5,196	4,958
	SR 40 Off-Ramp	0.25	4	Basic	3,992	3,735	4,356	4,345	5,765	5,455	5,196	4,957
	End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	2,640	3,726	2,825	2,792	3,885	3,656	3,076	2,943

<sup>1</sup>Rounded to nearest 0.25 miles, <sup>2</sup>Assuming HCM segmentation types

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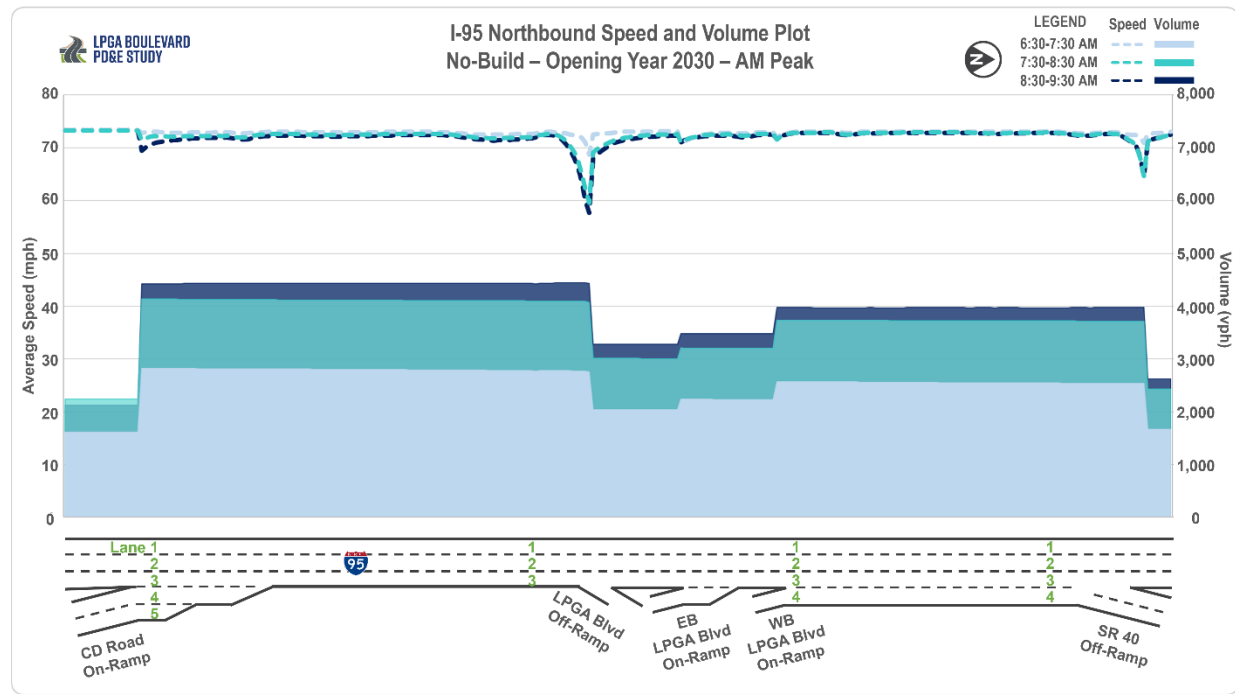


Figure 28. I-95 Northbound Speed and Volume Plot – No-Build Opening Year 2030 AM

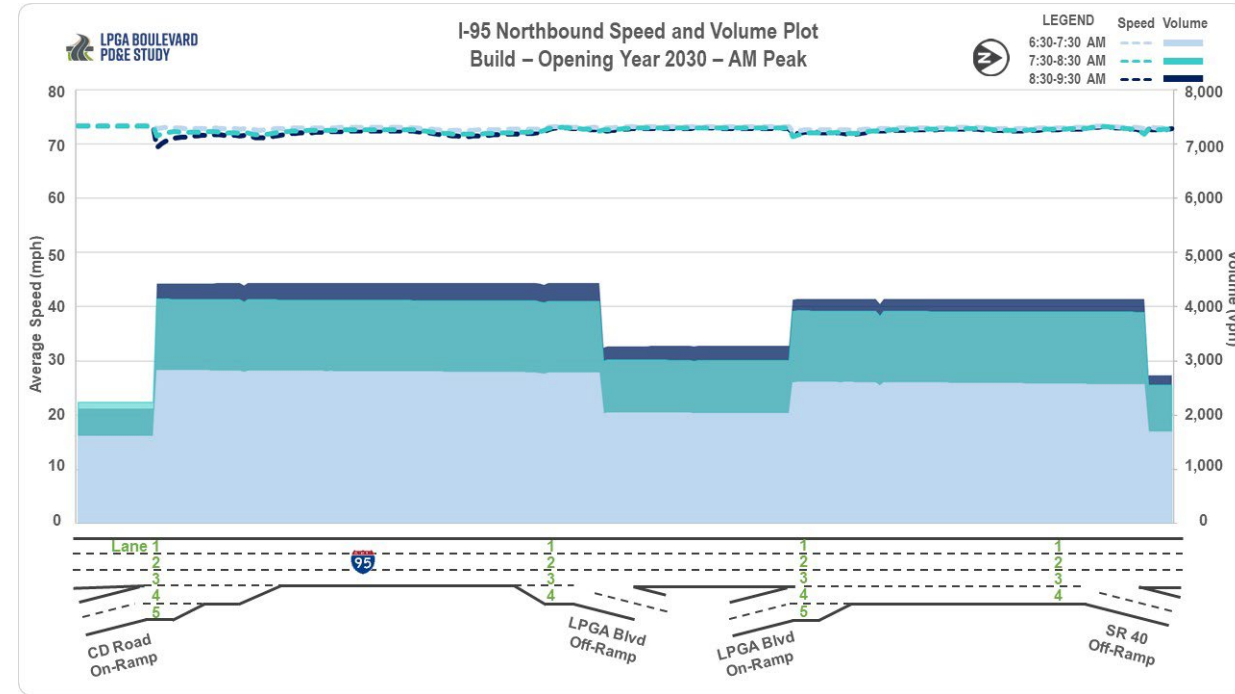


Figure 29. I-95 Northbound Speed and Volume Plot – Build Opening Year 2030 AM

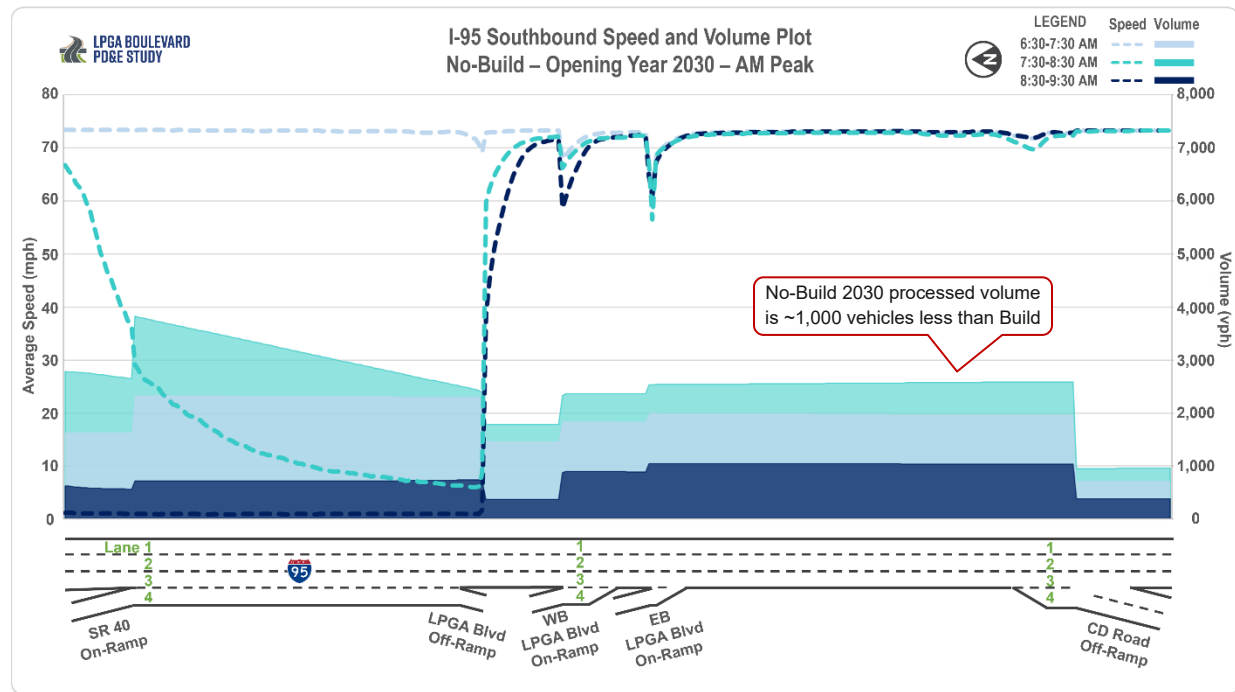


Figure 30. I-95 Southbound Speed and Volume Plot – No-Build Opening Year 2030 AM

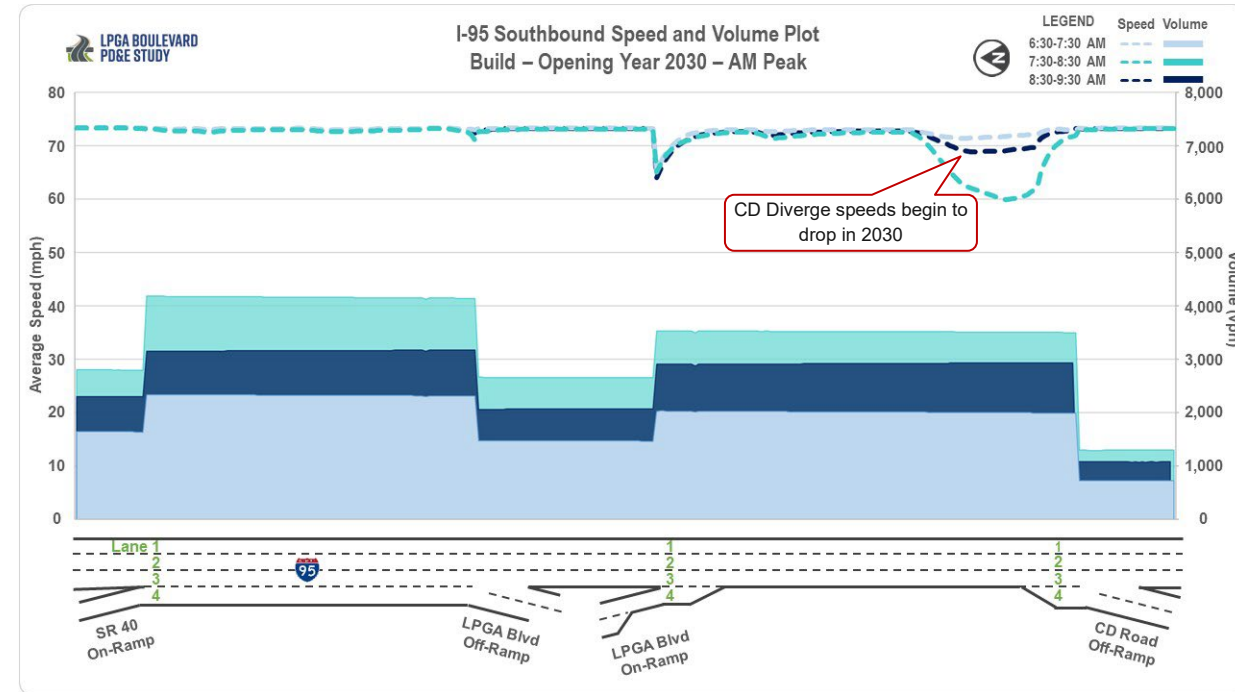


Figure 31. I-95 Southbound Speed and Volume Plot – Build Opening Year 2030 AM

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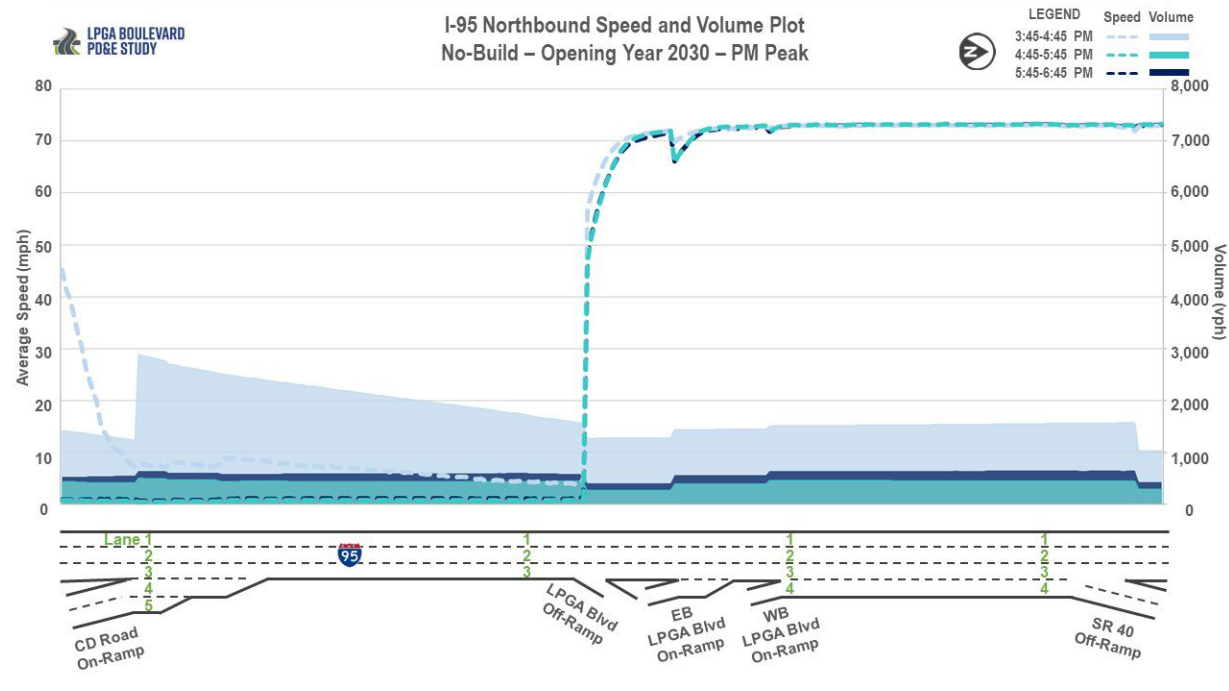


Figure 32. I-95 Northbound Speed and Volume Plot – No-Build Opening Year 2030 PM

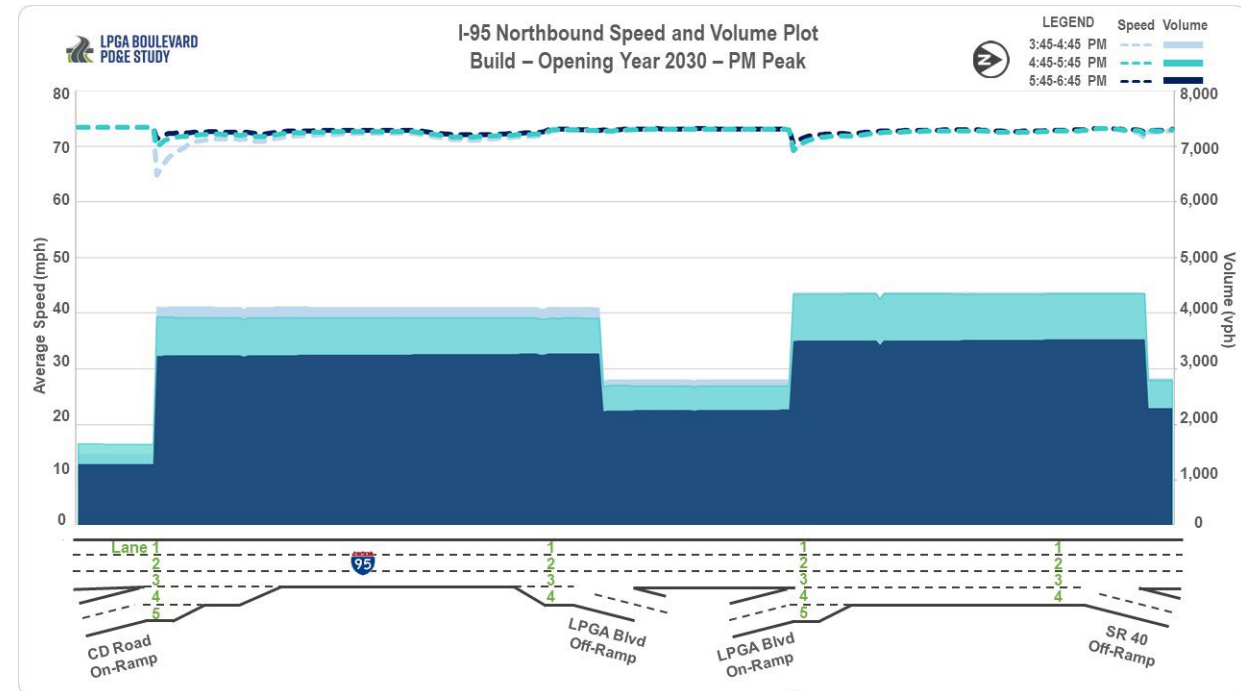


Figure 33. I-95 Northbound Speed and Volume Plot – Build Opening Year 2030 PM

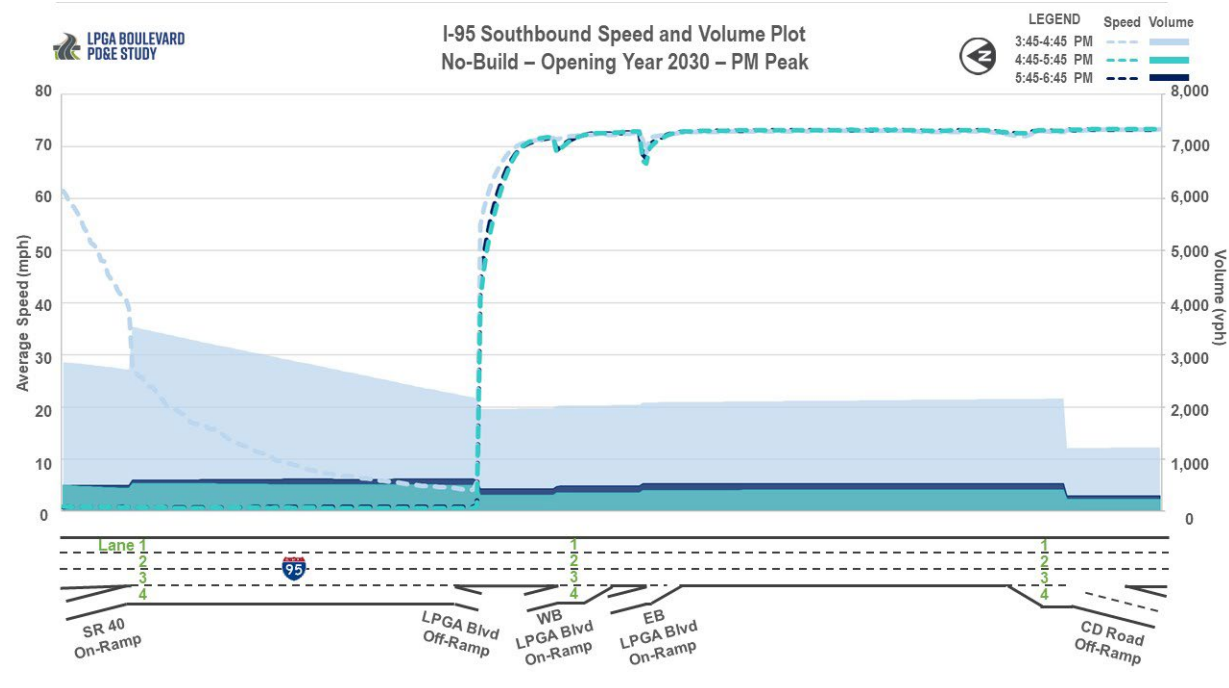


Figure 34. I-95 Southbound Speed and Volume Plot – No-Build Opening Year 2030 PM

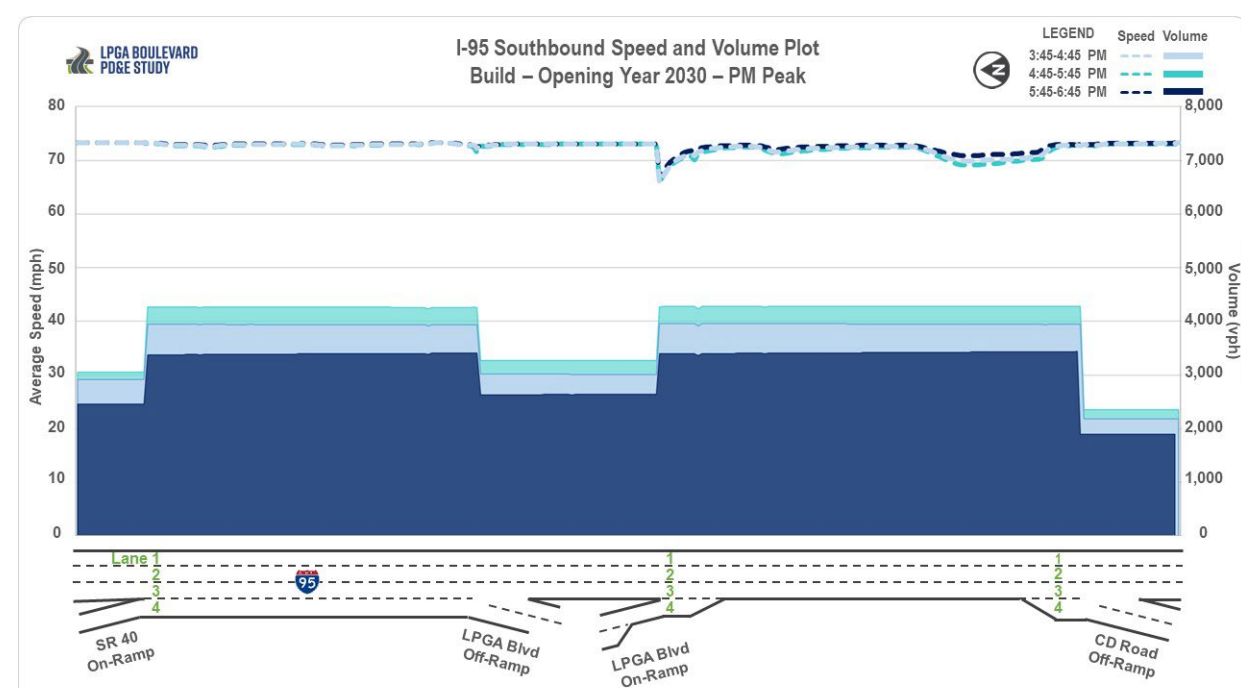


Figure 35. I-95 Southbound Speed and Volume Plot – Build Opening Year 2030 PM

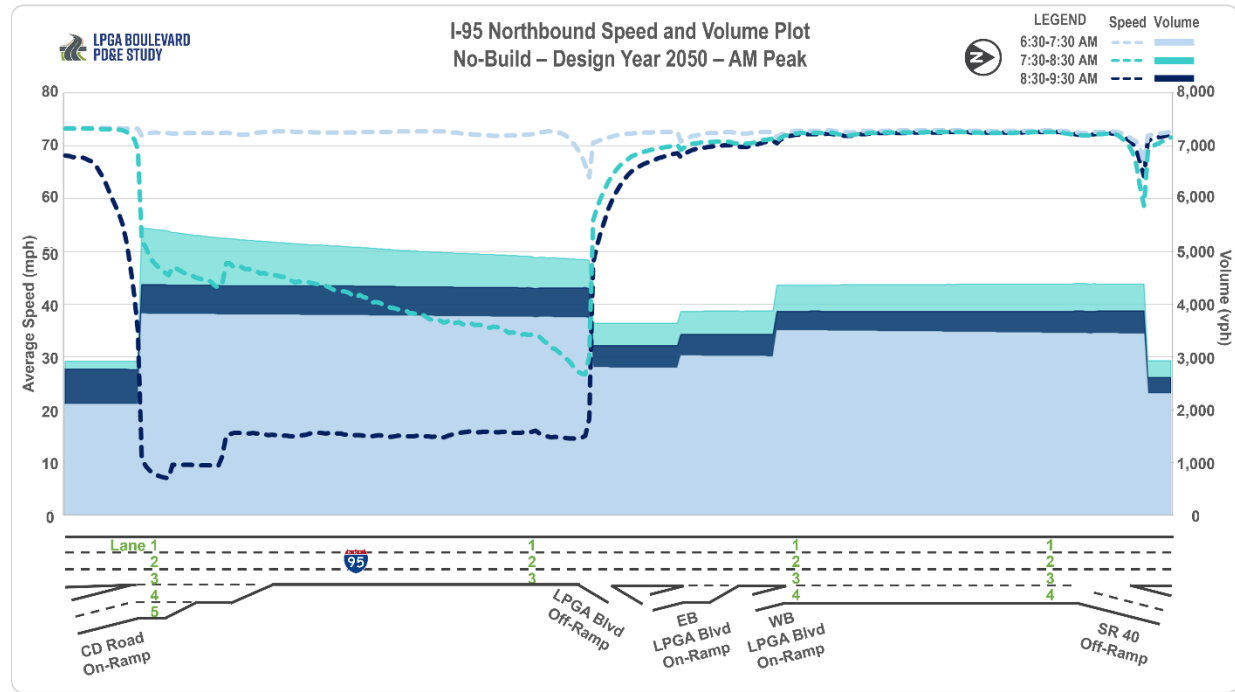


Figure 36. I-95 Northbound Speed and Volume Plot – No-Build Design Year 2050 AM

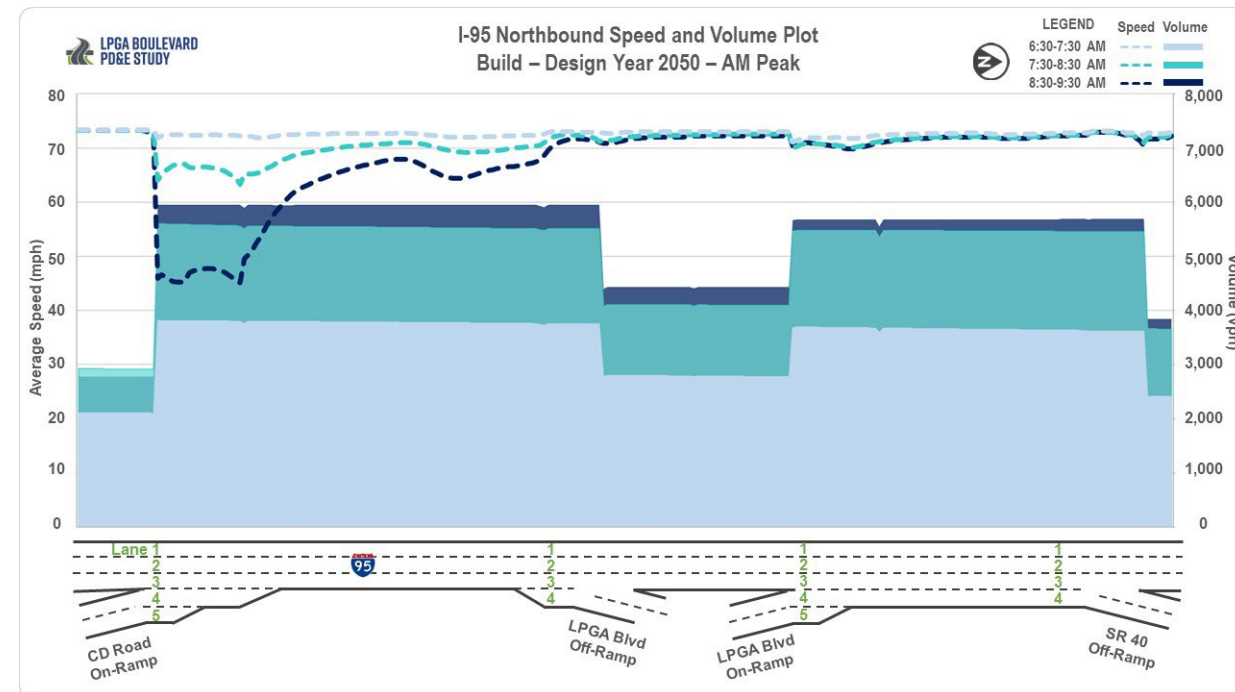


Figure 37. I-95 Northbound Speed and Volume Plot – Build Design Year 2050 AM

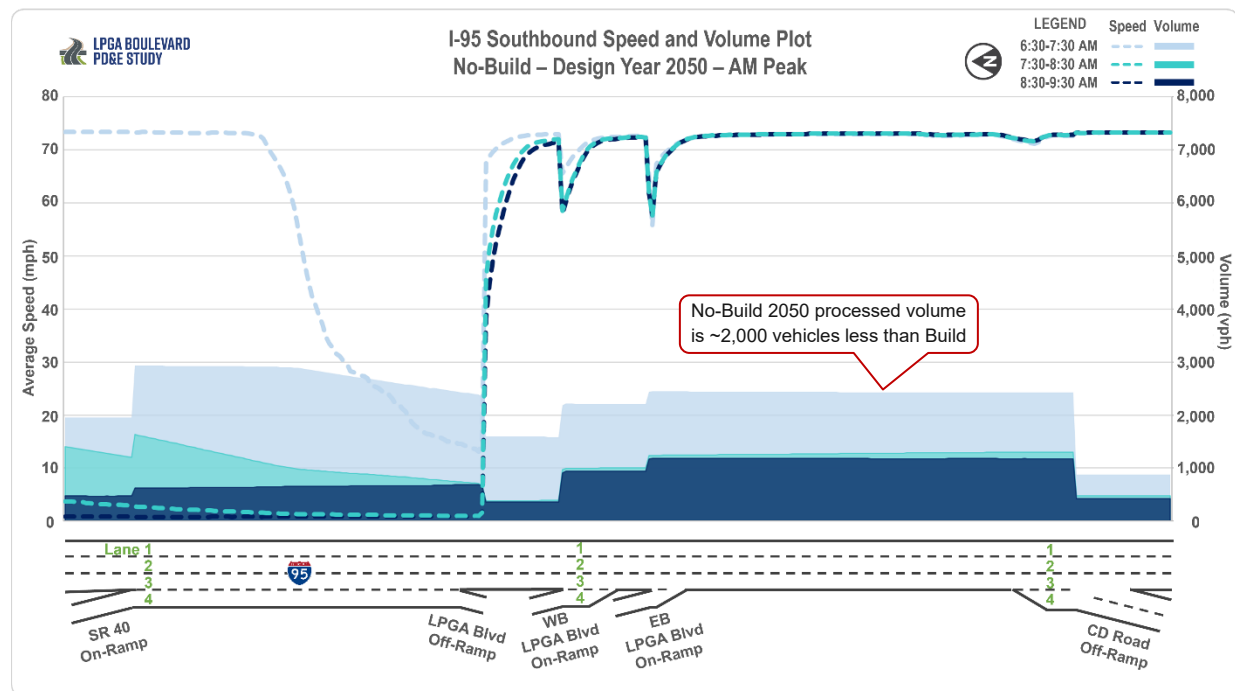


Figure 38. I-95 Southbound Speed and Volume Plot – No-Build Design Year 2050 AM

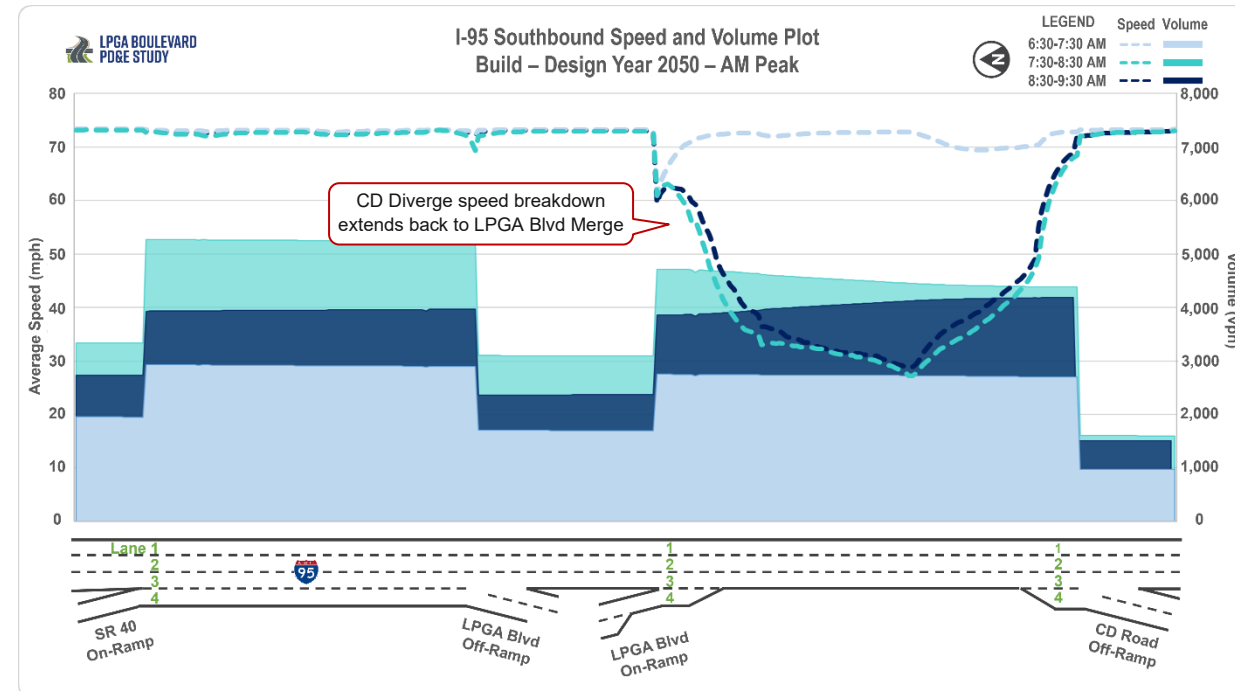


Figure 39. I-95 Southbound Speed and Volume Plot – Build Design Year 2050 AM

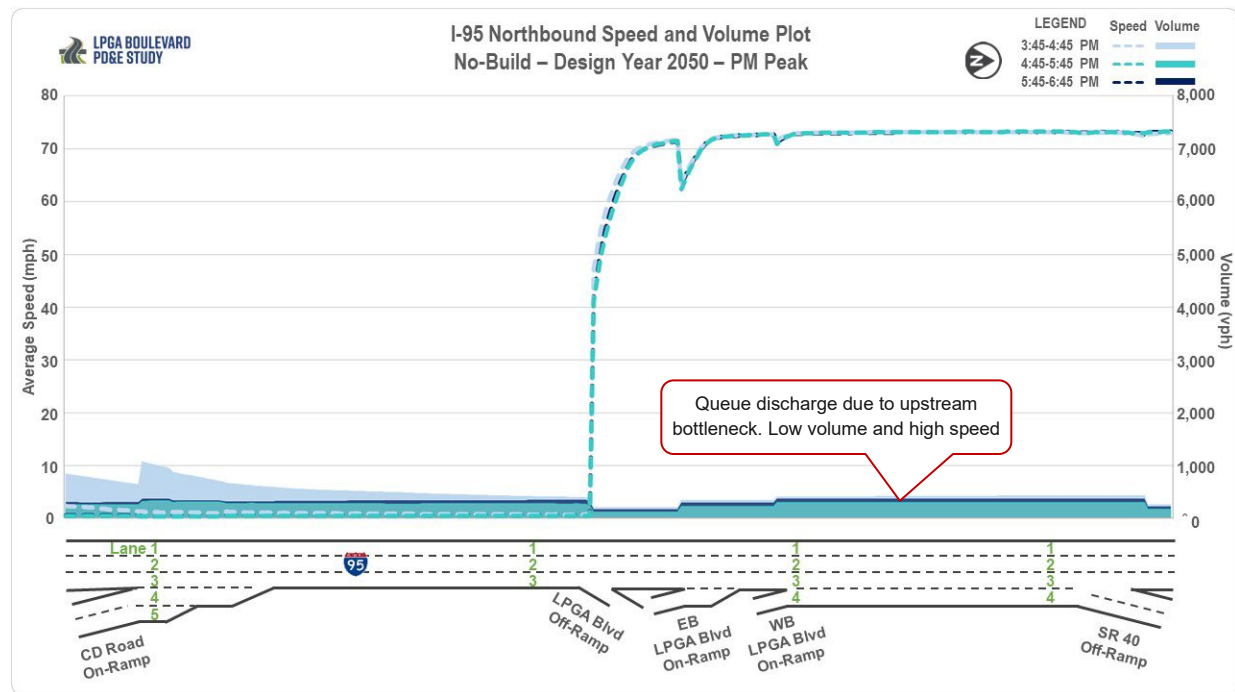


Figure 40. I-95 Northbound Speed and Volume Plot – No-Build Design Year 2050 PM

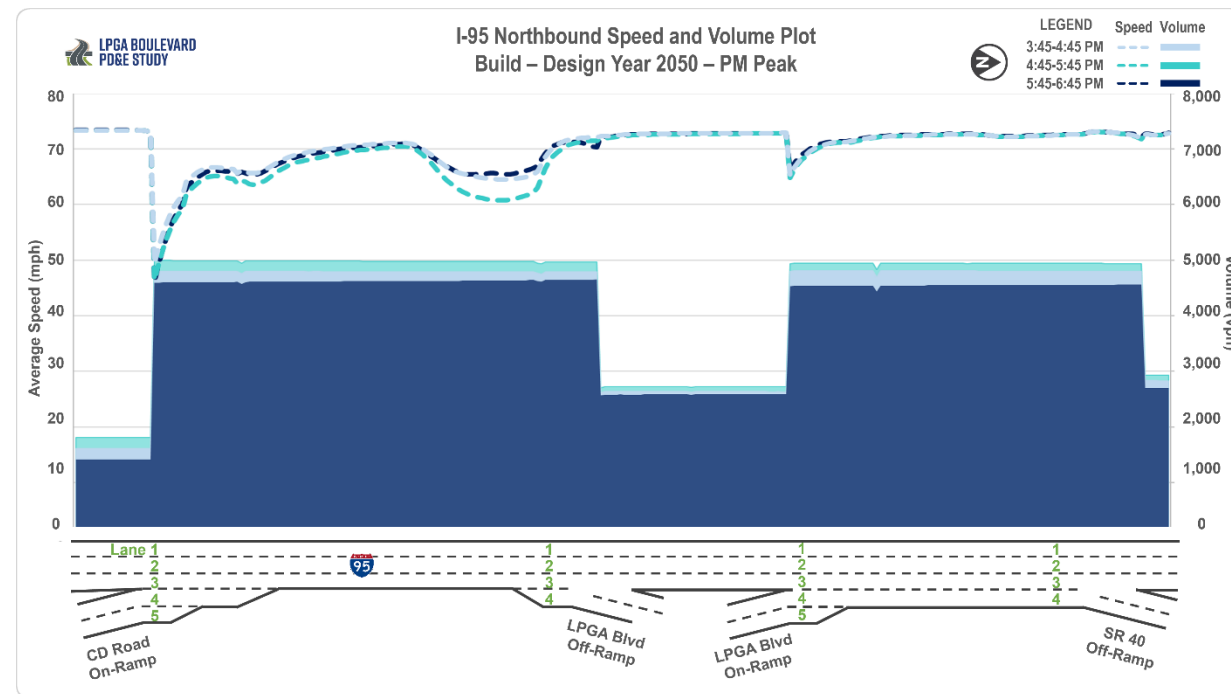


Figure 41. I-95 Northbound Speed and Volume Plot – Build Design Year 2050 PM

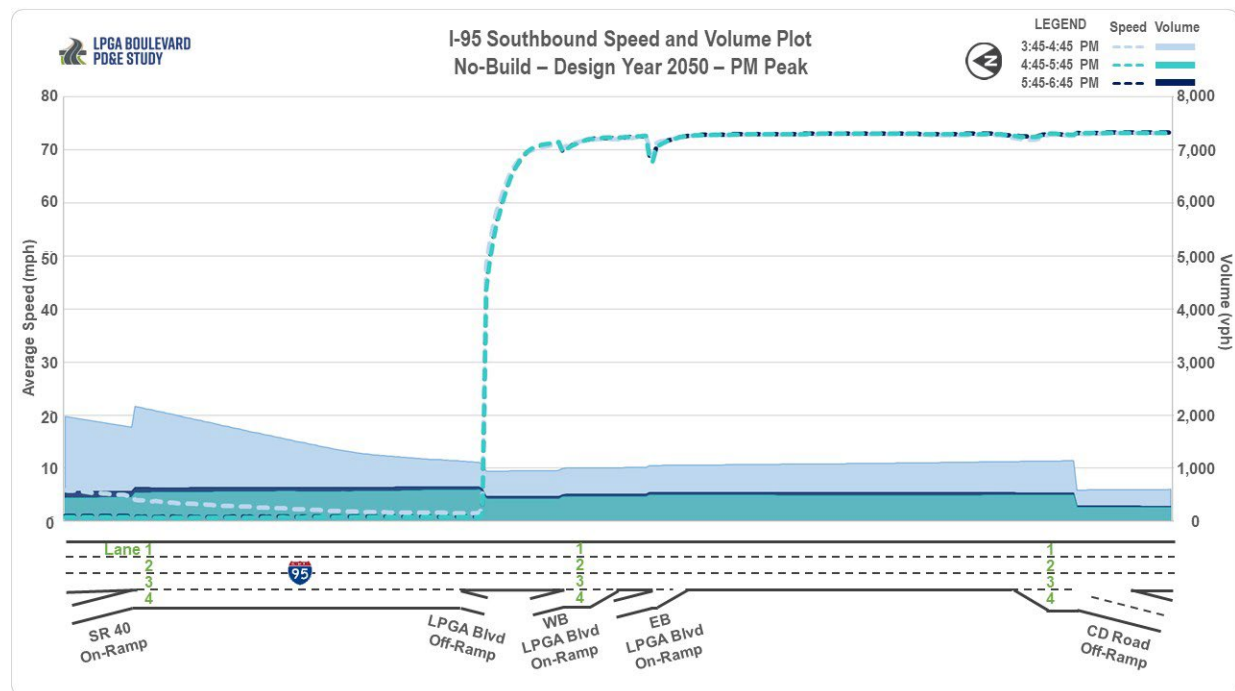


Figure 42. I-95 Southbound Speed and Volume Plot – No-Build Design Year 2050 PM

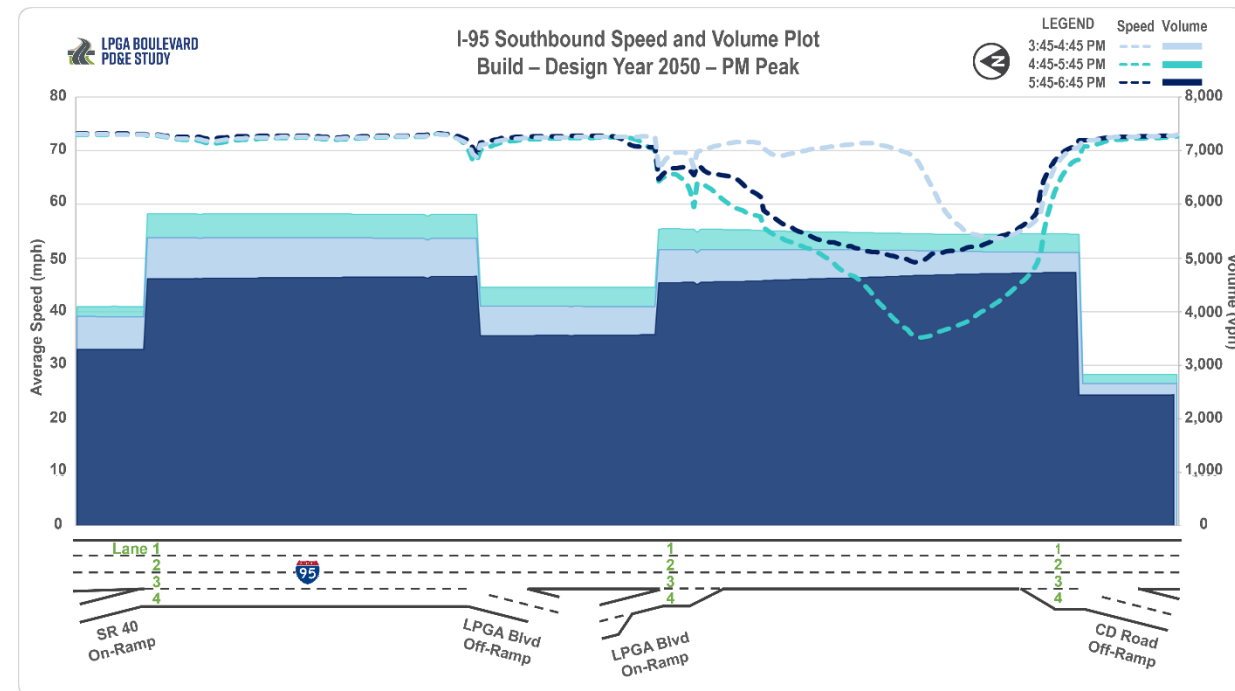


Figure 43. I-95 Southbound Speed and Volume Plot – Build Design Year 2050 PM

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Table 14. I-95 Density and LOS – Opening Year 2030

Alt	I-95 Segments	Segment Properties			Hour 1 (6:30 AM - 7:30 AM)		Hour 2 (7:30 AM - 8:30 AM)		Hour 3 (8:30 AM - 9:30 AM)		Hour 1 (3:45 PM - 4:45 PM)		Hour 2 (4:45 PM - 5:45 PM)		Hour 3 (5:45 PM - 6:45 PM)	
		Dist <sup>1</sup> (mi)	Lanes	Type <sup>2</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>
<b>I-95 Southbound – No-Build</b>																
I-95 SB No-Build	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	7.4	A	19.3	C	184.2	F	22.0	C	191.4	F	190.1	F
	SR 40 On-Ramp	0.25	4	Basic	8.0	A	40.7	E	194.9	F	41.0	E	200.1	F	195.7	F
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	7.9	A	75.6	F	193.2	F	86.1	F	196.9	F	194.2	F
	LPGA Blvd Off-Ramp	0.25	4	Diverge	8.0	A	97.7	E	186.6	E	128.0	E	195.6	E	192.2	E
	From LPGA Blvd Off-Ramp to WB LPGA Blvd On-Ramp	0.50	3	Basic	6.7	A	8.6	A	2.0	A	9.7	A	1.6	A	2.2	A
	WB LPGA Blvd On-Ramp	0.25	4	Merge	6.5	A	8.4	A	3.3	A	7.0	A	1.2	A	1.7	A
	From WB LPGA Blvd On-Ramp to EB LPGA Blvd On-Ramp	0.25	3	Basic	8.4	A	10.9	A	4.1	A	9.4	A	1.6	A	2.2	A
	EB LPGA Blvd On-Ramp	0.00	4	Merge	7.9	A	10.4	B	4.2	A	7.5	A	1.5	A	1.9	A
	EB LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2.00	3	Basic	9.1	A	11.8	B	4.8	A	9.7	A	1.9	A	2.4	A
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	6.8	A	9.0	A	3.6	A	7.4	A	1.4	A	1.8	A
End Study Area, South of US 92/I-4 CD Off-Ramp	0.50	3	Basic	3.3	A	4.4	A	1.7	A	5.6	A	1.0	A	1.4	A	
<b>I-95 Southbound – Build</b>																
I-95 SB Build	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	7.4	A	12.7	B	10.4	A	13.3	B	13.9	B	11.2	B
	SR 40 On-Ramp	0.25	4	Basic	8.0	A	14.3	B	10.8	A	13.5	B	14.6	B	11.6	B
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	7.9	A	14.3	B	10.8	A	13.5	B	14.6	B	11.6	B
	LPGA Blvd Off-Ramp	0.25	4	Diverge	7.9	A	14.2	B	10.9	B	13.5	B	14.6	B	11.7	B
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	1.00	3	Basic	6.7	A	12.1	B	9.4	A	13.8	B	14.9	B	12.0	B
	LPGA Blvd On-Ramp	0.25	4	Merge	7.3	A	12.8	B	10.5	B	14.2	B	15.5	B	12.1	B
	From LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2.00	3	Basic	9.2	A	16.9	B	13.5	B	18.4	C	20.0	C	15.8	B
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	6.8	A	12.5	B	10.1	B	13.6	B	14.8	B	11.8	B
	End Study Area, South of US 92/I-4 CD Off-Ramp	0.50	3	Basic	3.3	A	5.9	A	4.9	A	9.9	A	10.7	A	8.6	A
	<b>I-95 Northbound – No-Build</b>															
I-95 NB No-Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	7.3	A	10.2	A	4.8	A	34.1	D	189.9	F	94.0	F
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	4	Merge	7.7	A	8.6	A	6.3	A	77.8	E	194.1	E	96.9	E
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	9.7	A	11.4	B	7.7	A	85.7	E	186.4	E	92.4	E
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.50	4	Basic	12.8	B	18.9	C	9.9	A	112.5	F	188.1	F	91.6	F
	From LPGA Blvd Off-Ramp to LPGA Blvd EB On-Ramp	0.25	3	Diverge	12.8	B	19.7	B	10.8	B	134.3	E	191.2	E	91.4	E
	LPGA Blvd EB On-Ramp	0.50	4	Basic	9.3	A	14.0	B	7.7	A	6.2	A	1.4	A	1.0	A
	From LPGA Blvd EB On-Ramp to LPGA Blvd WB On-Ramp	0.25	3	Merge	7.7	A	11.1	B	6.0	A	5.0	A	1.4	A	1.0	A
	LPGA Blvd WB On-Ramp	0.25	4	Basic	10.2	A	14.7	B	8.0	A	6.7	A	1.8	A	1.3	A
	From LPGA Blvd WB On-Ramp to SR 40 Off-Ramp	0.25	3	Merge	8.8	A	12.8	B	6.8	A	5.2	A	1.6	A	1.1	A
	SR 40 Off-Ramp	1.25	4	Basic	8.7	A	12.8	B	6.8	A	5.3	A	1.6	A	1.1	A
End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	8.7	A	13.0	B	7.0	A	5.4	A	1.5	A	1.1	A	
<b>I-95 Northbound – Build</b>																
I-95 NB Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	7.3	A	10.2	A	4.8	A	6.7	A	7.5	A	2.9	A
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	5	Merge	7.7	A	11.5	B	6.3	A	12.1	B	11.0	B	4.5	A
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	9.7	A	14.3	B	7.7	A	14.4	B	13.6	B	5.6	A
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.50	3	Basic	12.8	B	19.0	C	9.9	A	19.1	C	18.1	C	7.2	A
	From LPGA Blvd Off-Ramp	0.25	4	Diverge	9.5	A	14.1	B	7.6	A	14.1	B	13.4	B	5.6	A
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	0.75	3	Basic	9.3	A	13.8	B	12.3	B	12.8	B	12.3	B	8.5	A
	LPGA Blvd On-Ramp	0.25	5	Merge	7.2	A	10.9	B	5.1	A	12.3	B	12.3	B	4.3	A
	From LPGA Blvd On-Ramp to SR 40 Off-Ramp	1.25	4	Basic	8.9	A	13.5	B	11.5	B	15.1	B	15.0	B	9.8	A
	SR 40 Off-Ramp	0.25	4	Basic	8.8	A	13.3	B	14.1	B	15.0	B	14.9	B	12.1	B
	End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	7.7	A	11.7	B	6.2	A	12.9	B	12.8	B	5.3	A

<sup>1</sup>Rounded to nearest 0.25 miles, <sup>2</sup>Assuming HCM segmentation types,

<sup>3</sup>LOS thresholds based on Vissim density in vehicles per mile per lane: HCM Basic Freeway — LOS A (≤11), LOS B (>11-18), LOS C (>18-26), LOS D (>26-35), LOS E (>35-45), LOS F (>45);

HCM Merge/Diverge — LOS A (≤10), LOS B (>10-20), LOS C (>20-28), LOS D (>28-35), LOS E (>35), LOS F (demand exceeds capacity)

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Table 15. I-95 Density and LOS – Design Year 2050

Alt	I-95 Segments	Segment Properties			Hour 1 (6:30 AM - 7:30 AM)		Hour 2 (7:30 AM - 8:30 AM)		Hour 3 (8:30 AM - 9:30 AM)		Hour 1 (3:45 PM - 4:45 PM)		Hour 2 (4:45 PM - 5:45 PM)		Hour 3 (5:45 PM - 6:45 PM)	
		Dist <sup>1</sup> (mi)	Lanes	Type <sup>2</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>	Density	LOS <sup>3</sup>
<b>I-95 Southbound – No-Build</b>																
I-95 SB No-Build	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	8.9	A	133.1	F	187.1	F	118.6	F	191.2	F	189.0	F
	SR 40 On-Ramp	0.25	4	Basic	10.0	A	156.9	F	194.6	F	141.4	F	196.8	F	193.6	F
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	20.2	C	182.2	F	195.8	F	169.5	F	195.2	F	193.1	F
	LPGA Blvd Off-Ramp	0.25	4	Diverge	43.7	F	183.4	F	189.4	F	179.0	F	191.3	F	189.0	F
	From LPGA Blvd Off-Ramp to WB LPGA Blvd On-Ramp	0.50	3	Basic	7.4	A	2.0	A	2.0	A	4.9	A	2.2	A	2.4	A
	WB LPGA Blvd On-Ramp	0.25	4	Merge	7.9	A	3.7	A	3.5	A	3.5	A	1.6	A	1.8	A
	From WB LPGA Blvd On-Ramp to EB LPGA Blvd On-Ramp	0.25	3	Basic	10.1	A	4.6	A	4.3	A	4.7	A	2.1	A	2.3	A
	EB LPGA Blvd On-Ramp	0.00	4	Merge	10.2	B	5.2	A	4.9	A	3.8	A	1.8	A	2.0	A
	EB LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2.00	3	Basic	11.2	B	5.8	A	5.4	A	5.0	A	2.2	A	2.5	A
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	8.4	A	4.5	A	4.0	A	3.9	A	1.7	A	1.8	A
Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	4.0	A	2.2	A	1.9	A	2.7	A	1.1	A	1.3	A	
<b>I-95 Southbound – Build</b>																
I-95 SB Build	Begin Study Area, North of SR 40 On-Ramp	0.50	3	Basic	8.9	A	15.2	B	12.4	B	17.8	B	18.7	C	15.0	B
	SR 40 On-Ramp	0.25	4	Basic	10.0	A	18.2	C	13.5	B	18.5	C	20.1	C	15.9	B
	From SR 40 On-Ramp to LPGA Blvd Off-Ramp	1.25	4	Basic	10.0	A	18.1	C	13.6	B	18.6	C	20.1	C	15.9	B
	LPGA Blvd Off-Ramp	0.25	4	Diverge	9.9	A	18.0	B	13.6	B	18.6	B	20.3	C	16.1	B
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	1.00	3	Basic	7.7	A	14.2	B	10.8	A	18.9	C	20.7	C	16.5	B
	LPGA Blvd On-Ramp	0.25	4	Merge	10.2	B	19.9	B	16.2	B	18.8	B	22.5	C	17.6	B
	From LPGA Blvd On-Ramp to US 92/I-4 CD Off-Ramp	2.00	3	Basic	12.7	B	44.0	E	38.1	E	26.4	D	43.0	E	29.9	D
	US 92/I-4 CD Off-Ramp	0.25	4	Diverge	9.3	A	17.4	B	16.4	B	18.9	B	21.4	C	17.4	B
	End Study Area, South of US 92/I-4 CD Off-Ramp	0.50	3	Basic	4.4	A	7.3	A	6.9	A	12.2	B	13.1	B	11.3	B
	<b>I-95 Northbound – No-Build</b>															
I-95 NB No-Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	9.6	A	13.4	B	10.0	A	137.5	F	195.7	F	96.0	F
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	4	Merge	10.5	B	25.9	C	57.6	E	172.9	E	195.6	E	98.9	E
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	13.1	B	32.7	D	56.9	E	174.9	E	190.2	E	95.2	E
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.50	4	Basic	17.4	B	45.8	F	47.9	F	187.4	F	194.9	F	96.2	F
	From LPGA Blvd Off-Ramp to LPGA Blvd EB On-Ramp	0.25	3	Diverge	17.7	B	58.6	F	48.1	E	185.9	E	193.8	E	96.8	E
	LPGA Blvd EB On-Ramp	0.50	4	Basic	12.9	B	18.3	C	8.6	A	1.0	A	0.6	A	0.5	A
	From LPGA Blvd EB On-Ramp to LPGA Blvd WB On-Ramp	0.25	3	Merge	10.5	B	13.7	B	6.2	A	1.2	A	0.8	A	0.5	A
	LPGA Blvd WB On-Ramp	0.25	4	Basic	13.8	B	18.2	C	8.1	A	1.6	A	1.0	A	0.7	A
	From LPGA Blvd WB On-Ramp to SR 40 Off-Ramp	0.25	3	Merge	12.0	B	15.1	B	6.7	A	1.4	A	1.0	A	0.6	A
	SR 40 Off-Ramp	1.25	4	Basic	11.9	B	15.1	B	6.7	A	1.4	A	1.0	A	0.6	A
End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	12.0	B	15.8	B	6.8	A	1.5	A	1.0	A	0.6	A	
<b>I-95 Northbound – Build</b>																
I-95 NB Build	Begin Study Area, South of US 92/I-4 CD On-Ramp	1.25	3	Basic	9.6	A	13.3	B	6.3	A	7.3	A	8.2	A	3.2	A
	US 92/I-4 CD On-Ramp (1 <sup>st</sup> Merge)	0.25	5	Merge	10.5	B	16.9	B	16.2	B	17.0	B	18.6	B	8.5	A
	US 92/I-4 CD On-Ramp (2 <sup>nd</sup> Merge)	0.25	4	Merge	13.1	B	8.4	A	21.7	C	18.2	B	7.9	A	8.8	A
	From US 92/I-4 CD On-Ramp to LPGA Blvd Off-Ramp	1.50	3	Basic	17.4	B	20.0	C	10.6	A	23.5	C	19.2	C	7.5	A
	From LPGA Blvd Off-Ramp	0.25	4	Diverge	12.9	B	19.1	B	10.5	B	16.9	B	17.8	B	8.2	A
	From LPGA Blvd Off-Ramp to LPGA Blvd On-Ramp	0.75	3	Basic	12.8	B	18.9	C	16.9	B	12.1	B	12.5	B	9.8	A
	LPGA Blvd On-Ramp	0.25	5	Merge	10.2	B	15.4	B	7.1	A	13.9	B	14.4	B	5.8	A
	From LPGA Blvd On-Ramp to SR 40 Off-Ramp	1.25	4	Basic	12.6	B	18.9	C	16.0	B	16.6	B	17.1	B	12.7	B
	SR 40 Off-Ramp	0.25	4	Basic	12.4	B	18.7	C	19.5	C	16.5	B	17.0	B	15.6	B
	End Study Area, North of SR 40 Off-Ramp	0.25	3	Basic	11.1	B	16.8	B	8.8	A	13.0	B	13.5	B	6.2	A

<sup>1</sup>Rounded to nearest 0.25 miles, <sup>2</sup>Assuming HCM segmentation types,

<sup>3</sup>LOS thresholds based on Vissim density in vehicles per mile per lane: HCM Basic Freeway — LOS A (≤11), LOS B (>11-18), LOS C (>18-26), LOS D (>26-35), LOS E (>35-45), LOS F (>45)

HCM Merge/Diverge — LOS A (≤10), LOS B (>10-20), LOS C (>20-28), LOS D (>28-35), LOS E (>35), LOS F (demand exceeds capacity)

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## 6.4 LPGA Boulevard Arterial Operations

The travel time is measured from Tournament Drive to Clyde Morris Boulevard, consistent with the AOI and calibration travel time measurements.

### Opening Year 2030

The average travel times and speeds for Opening Year 2030 are shown in **Table 16**. The Build travel times are between 6.1 and 8.1 minutes. These are slightly better than Design Year 2050 travel times described in the next section (7.1 to 10.2 minutes) due to lower traffic volumes and less eastbound/westbound congestion at Clyde Morris Boulevard.

The No-Build travel times are poor, approximately 10 mph or less in the AM peak hour and 5 mph or less in the PM peak hour.

*Table 16. Travel Time and Speed – Opening Year 2030*

Dir	Segment	Dist	Opening Year 2030			
			No-Build		Build	
			Travel Time	Avg Speed	Travel Time	Avg Speed
<b>AM Peak Hour</b>						
EB	From Tournament Dr to Clyde Morris Blvd	2.5 mi	13.8 min	10.8 mph	6.5 min	22.9 mph
WB	From Clyde Morris Blvd to Tournament Dr	2.5 mi	16.7 min	9.0 mph	6.1 min	24.7 mph
<b>PM Peak Hour</b>						
EB	From Tournament Dr to Clyde Morris Blvd	2.5 mi	49.4 min	3.0 mph	7.5 min	20.1 mph
WB	From Clyde Morris Blvd to Tournament Dr	2.5 mi	104.4 min	1.4 mph	8.1 min	18.5 mph

*Note: Design speed is 35 mph from Tymber Creek Rd. to Williamson Blvd., and 45 mph from Tournament Dr. to Tymber Creek Rd.*

### Design Year 2050

The average travel times and speeds for Design Year 2050 are shown in **Table 17**. The No-Build Alternative average speeds are very low due to the gridlocked network. The Build Alternative travel times are between 7.1 and 10.2 minutes, which are slightly higher than the Existing Year 2021 travel times. However, it is noted that the Build Alternative travel times are impacted by poor operations at Clyde Morris Boulevard – this intersection does not have planned or programmed improvements and LPGA Boulevard remains as four-lane at the intersection, with single left-turn lanes on all approaches. This configuration results in queuing on all approaches and the intersection delay, shown in the next section, exceeds 200 s/veh. However, the Build Alternative shows significant travel times improvement over the No-Build Alternative.

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## Interchange Modification Report

Table 17. Travel Time and Speed – Design Year 2050

Dir	Segment	Dist	Design Year 2050			
			No-Build		Build	
			Travel Time	Avg Speed	Travel Time	Avg Speed
<b>AM Peak Hour</b>						
EB	From Tournament Dr to Clyde Morris Blvd	2.5 mi	14.4 min	10.4 mph	7.3 min	20.6 mph
WB	From Clyde Morris Blvd to Tournament Dr	2.5 mi	22.1 min	6.8 mph	7.1 min	21.2 mph
<b>PM Peak Hour</b>						
EB	From Tournament Dr to Clyde Morris Blvd	2.5 mi	60.1 min	2.5 mph	11.7 min	12.9 mph
WB	From Clyde Morris Blvd to Tournament Dr	2.5 mi	107.3 min	1.4 mph	10.2 min	14.8 mph

Note: Design speed is 35 mph from Tymber Creek Rd. to Williamson Blvd, and 45 mph from Tournament Dr. to Tymber Creek Rd.

## 6.5 Intersection Operations

The operation of proposed intersection configurations was evaluated with respect to intersection delays and LOS. It should be noted that the LOS standard in Volusia County is LOS E. The LOS target for FDOT LOS D.

### Opening Year 2030

The estimated LOS results for Opening Year 2030 are in **Table 18**. Ramp terminal queue length results are in **Table 19**. Detailed results by movement, including queue length, are in **Appendix J**. All intersections except for Concierge Boulevard are signalized.

In the No-Build Alternative, nearly all intersections operate at LOS F, with delays considerably over 80 seconds per vehicle. This is due to the gridlocked network described earlier. LOS F conditions start as early as the first analysis hour. While the AM peak period has less severe delays, conditions worsen by the third analysis hour. In the Build Alternative, all intersections and ramp terminals operate at LOS E or better except for Tymber Creek Road which operates at LOS F in the third hour. However, the proposed improvements along LPGA results to a substantial reduction of delays at Tymber Creek Road—from 314.7 seconds to 98.6 seconds—a 69 percent reduction in intersection delay. In the PM peak period, all intersections and ramp terminals operate at LOS D or better except Clyde Morris Boulevard and Williamson Boulevard which operate at LOS E.

The proposed improvements are expected to substantially reduce the intersections queues as shown in **Table 19**.

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Table 18. Intersection Delay and LOS – Opening Year 2030

LPGA Blvd Intersection	Opening Year 2030							
	AM Peak				PM Peak			
	No-Build		Build		No-Build		Build	
	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
<b>Hour 1</b>	<b>Hour 1 (6:30 AM - 7:30 AM)</b>				<b>Hour 1 (3:45 PM - 4:45 PM)</b>			
Tournament Dr	22.1	C	19.9	B	408.5	F	15.9	B
Tymber Creek Rd	59.5	E	35.0	C	645.3	F	47.8	D
Champions Dr	61.7	E	8.9	A	777.1	F	22.3	C
Tomoka Farms Rd	66.7	E	29.1	C	506.3	F	25.6	C
I-95 SB Ramps	28.7	C	11.0 (NW) 19.6 (SW)	B B	610.3	F	10.1 (NW) 23.3 (SW)	B C
I-95 NB Ramps	20.2	C	20.1 (SE) 11.9 (NE)	C B	597.0	F	21.7 (SE) 24.0 (NE)	C C
Technology Blvd	22.3	C	25.4	C	464.2	F	45.9	D
Williamson Blvd	49.0	D	44.8	D	400.2	F	57.3	E
Concierge Blvd*	10.0	B	8.6	A	1452.7	F	9.5	A
Clyde Morris Blvd	30.0	C	35.3	D	240.9	F	55.6	E
<b>Hour 2</b>	<b>Hour 2 (7:30 AM - 8:30 AM)</b>				<b>Hour 2 (4:45 PM - 5:45 PM)</b>			
Tournament Dr	223.9	F	29.9	C	887.5	F	14.0	B
Tymber Creek Rd	297.7	F	57.1	E	979.4	F	49.7	D
Champions Dr	247.2	F	11.6	B	1312.6	F	23.3	C
Tomoka Farms Rd	166.2	F	26.8	C	1171.3	F	25.6	C
I-95 SB Ramps	191.8	F	14.2 (NW) 17.8 (SW)	B B	1317.4	F	10.3 (NW) 24.0 (SW)	B C
I-95 NB Ramps	30.3	C	21.5 (SE) 13.2 (NE)	C B	1523.6	F	21.0 (SE) 23.7 (NE)	C C
Technology Blvd	28.3	C	26.2	C	1405.9	F	48.3	D
Williamson Blvd	66.3	E	55.0	D	1531.0	F	61.9	E
Concierge Blvd*	69.5	F	9.9	A	5426.9	F	9.6	A
Clyde Morris Blvd	38.2	D	46.6	D	1271.5	F	57.6	E
<b>Hour 3</b>	<b>Hour 3 (8:30 AM - 9:30 AM)</b>				<b>Hour 3 (5:45 PM - 6:45 PM)</b>			
Tournament Dr	393.8	F	18.6	B	971.2	F	10.5	B
Tymber Creek Rd	314.7	F	98.6	F	943.5	F	41.9	D
Champions Dr	354.5	F	12.3	B	1155.0	F	22.0	C
Tomoka Farms Rd	335.3	F	59.1	E	1011.5	F	23.9	C
I-95 SB Ramps	394.0	F	11.4 (NW) 18.3 (SW)	B B	1285.1	F	10.5 (NW) 19.8 (SW)	B B
I-95 NB Ramps	85.1	F	22.0 (SE) 13.8 (NE)	C B	1481.0	F	20.3 (SE) 21.2 (NE)	C C
Technology Blvd	52.6	D	28.3	C	1481.1	F	39.5	D
Williamson Blvd	58.1	E	50.2	D	2059.1	F	53.8	D
Concierge Blvd*	18.5	C	9.4	A	9789.1	F	8.5	A
Clyde Morris Blvd	35.8	D	44.4	D	2046.9	F	43.2	D

\*Worst movement delay reported (stop control intersection)

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Table 19. Ramp Terminal Queues – Opening Year 2030

		Opening Year 2030					
I-95 Ramp Terminal	Mvment	No-Build			Build		
		Avg Queue AM (PM)	Max Queue AM (PM)	Storage* Turn Bay / Off-Ramp	Avg Queue AM (PM)	Max Queue AM (PM)	Ramp Storage*
SB Ramp Terminal	EBT	38 (4)	430 (182)	-	17 (109)	275 (492)	-
	EBR	- (-)	- (-)	<b>500'</b>	6 (17)	109 (135)	<b>1,200'</b>
	WBL	- (-)	- (-)	<b>675'</b>	24 (26)	268 (256)	<b>675'</b>
	WBT	620 (1,407)	1,299 (1,461)	-	24 (26)	268 (256)	-
	SBL	<b>3,034 (4,116)</b>	<b>4,168 (4,168)</b>	<b>2,500'</b>	78 (23)	316 (202)	<b>650' / 3,325</b>
	SBR	3,083 (4,170)	4,222 (4,222)	<b>300' / 2,500'</b>	56 (46)	240 (178)	<b>725' / 2,625</b>
NB Ramp Terminal	EBL	- (-)	- (-)	<b>775'</b>	35 (93)	252 (380)	<b>1,000'</b>
	EBT	38 (16)	506 (191)	-	93 (63)	600 (494)	-
	WBT	73 (1203)	530 (1,267)	-	35 (120)	466 (684)	-
	WBR	- (-)	- (-)	<b>300'</b>	12 (68)	194 (535)	<b>1,400'</b>
	NBL	67 ( <b>4,698</b> )	344 ( <b>4,751</b> )	<b>800' / 2,775'</b>	33 (55)	192 (248)	<b>800' / 3,500'</b>
	NBR	183 ( <b>3,889</b> )	<b>648 (4,279)</b>	<b>625' / 2,775'</b>	88 (77)	410 (358)	<b>825' / 3,125'</b>
SB Ramp Signal	I-95	- (-)	- (-)	-	18 (36)	382 (560)	<b>1,500</b>

\*Turn bays measured from stop bar to end of taper; Off-ramps measured from stop bar to gore point

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Design Year 2050

Intersection delay and estimated LOS results for Design Year 2050 are in **Table 20**. Ramp terminal queue length results are in **Table 21**. Detailed results by movement, including queue length, are in **Appendix K**. All intersections except for Concierge Boulevard are signalized.

In the No-Build Alternative, nearly all intersections operate at LOS F, with delays exceedingly over 80 seconds per vehicle, similar to Opening Year 2030.

In the Build Alternative, the ramp terminal intersections operate at LOS C or better in all analysis hours. Several intersections operate at LOS F due to poor minor street operations affecting the overall intersection.

The intersections operating at LOS F in either peak during the Design Year 2050 are Tymber Creek Road, Tomoka Farms Road, Technology Boulevard, Williamson Boulevard, Concierge Boulevard, and Clyde Morris Boulevard.

- Tymber Creek Road would operate at LOS F in the first and third hour of the AM peak period. This is due to exceedingly high minor street delays on southbound Tymber Creek Road. Through coordination with Volusia County and the City of Daytona Beach, these developments would be responsible for any minor street improvements. The LPGA Boulevard widening is designed so it can receive additional minor street turn lanes.
- Tomoka Farms Road would operate at LOS F in the third hour of the AM peak period. In all other analysis hours operate at LOS E or better. Innovative intersections such as restricted crossing U-turn (RCUT) concept was initially evaluated at this location to minimize delay and improve traffic flow. However, during the alternatives public open house, which was conducted as part of this study, the residents in neighboring communities expressed opposition to any improvement that will prohibit some of the “traditional” intersection movements. Therefore, the RCUT concept was dismissed for further consideration and a traditional signal control was evaluated. Minor street improvements would be required to further improve LOS at Tomoka Farms; there is a development north of LPGA Boulevard and west of I-95 that is expected to reconstruct the north leg of this intersection. It is noted that this intersection is located adjacent to the I-95 southbound ramp terminal. Although the minor street delay drives up overall intersection delay, it is not expected to adversely impact I-95 ramp terminal operations. Design Year 2050 queue results show that LPGA Boulevard westbound queues do not spill back into the ramp terminal.
- Technology Boulevard is slightly over the LOS F threshold of 80 seconds per vehicle in the peak and third hour of the PM peak. A ThruCut intersection concept was initially evaluated at this location. However, based on the comments received from the public open house and coordination with the City of Daytona Beach and Volusia County, the ThruCut concept was dismissed, and a traditional signal was proposed. The City of Daytona Beach and Volusia County are planning for several roadway improvements north of this intersection including extending Technology Boulevard northeast to connect to Williamson Boulevard as well as extending Strickland Range Road. These improvements are still in the planning stages and not yet programmed. It is noted that

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this intersection is located adjacent to the I-95 northbound ramp terminal. Although the minor street delay drives up overall intersection delay, this intersection is not expected to adversely impact I-95 ramp terminal operations. Design Year 2050 queue results show that LPGA Boulevard eastbound queues do not spill back through the ramp terminal and the LPGA Boulevard interchange has sufficient capacity.

- Williamson Boulevard is a major north-south arterial connecting Daytona Beach and has a high volume of traffic. Several alternative intersection options (which could have improved the capacity of this intersection) including a displaced left-turn (DLT), restricted crossing U-turn (RCUT), and a median U-turn (MUT) were initially considered at this location, but discussions with the City of Daytona Beach and Volusia County led to selection of a traditional signalized intersection. In the discussion, the County wanted to preserve recent roadway improvements that were done along Williamson Boulevard. Additionally, there were concerns that alternative intersections may prohibit access to adjacent properties.
- Concierge Boulevard is a right-in, right-out, intersection. Eastbound queue spillback from Clyde Morris Boulevard and Williamson Boulevard would make it difficult for the minor street minor street right-turn movement to access LPGA Boulevard.
- Clyde Morris Boulevard is outside of the PD&E improvement limits and has no other plans for widening.

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## Interchange Modification Report

Table 20. Intersection Delay and LOS – Design Year 2050

LPGA Blvd Intersection	Design Year 2050							
	AM Peak				PM Peak			
	No-Build		Build		No-Build		Build	
	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
<b>Hour 1</b>	<b>Hour 1 (6:30 AM - 7:30 AM)</b>				<b>Hour 1 (3:45 PM - 4:45 PM)</b>			
Tournament Dr	134.7	F	24.9	C	759.7	F	35.6	D
Tymber Creek Rd	176.3	F	86.0	F	872.2	F	76.9	E
Champions Dr	117.1	F	11.2	B	1171.0	F	38.3	D
Tomoka Farms Rd	124.3	F	32.1	C	909.3	F	45.3	D
I-95 SB Ramps	105.9	F	12.1 (NW) 17.4 (SW)	B B	867.4	F	13.5 (NW) 29.2 (SW)	B C
I-95 NB Ramps	24.0	C	19.6 (SE) 14.9 (NE)	B B	1136.7	F	23.6 (SE) 29.0 (NE)	C C
Technology Blvd	31.8	C	28.8	C	919.0	F	59.1	E
Williamson Blvd	59.1	E	50.8	D	814.7	F	79.1	E
Concierge Blvd*	14.6	B	9.8	A	2928.6	F	42.2	E
Clyde Morris Blvd	34.1	C	40.9	D	520.0	F	161.6	F
<b>Hour 2</b>	<b>Hour 2 (7:30 AM - 8:30 AM)</b>				<b>Hour 2 (4:45 PM - 5:45 PM)</b>			
Tournament Dr	362.5	F	43.4	D	1000.4	F	33.2	C
Tymber Creek Rd	238.0	F	78.3	E	1019.2	F	78.2	E
Champions Dr	271.7	F	13.8	B	1559.4	F	45.4	D
Tomoka Farms Rd	302.3	F	64.5	E	1593.1	F	56.3	E
I-95 SB Ramps	401.8	F	19.4 (NW) 18.5 (SW)	B B	1547.8	F	14.1 (NW) 29.7 (SW)	B C
I-95 NB Ramps	184.6	F	26.6 (SE) 16.9 (NE)	C B	2015.3	F	28.0 (SE) 29.3 (NE)	C C
Technology Blvd	146.8	F	31.1	C	1723.2	F	83.6	F
Williamson Blvd	166.1	F	97.4	F	1726.5	F	134.1	F
Concierge Blvd*	598.5	F	35.7	D	7538.8	F	253.4	F
Clyde Morris Blvd	131.8	F	63.7	E	1564.9	F	264.0	F
<b>Hour 3</b>	<b>Hour 3 (8:30 AM - 9:30 AM)</b>				<b>Hour 3 (5:45 PM - 6:45 PM)</b>			
Tournament Dr	506.2	F	23.5	C	1238.9	F	24.8	C
Tymber Creek Rd	236.9	F	82.4	F	1375.6	F	78.2	E
Champions Dr	404.2	F	13.2	B	1553.6	F	46.4	D
Tomoka Farms Rd	332.8	F	82.3	F	1371.8	F	40.4	D
I-95 SB Ramps	426.0	F	15.6 (NW) 16.7 (SW)	B B	1606.1	F	13.1 (NW) 30.5 (SW)	B C
I-95 NB Ramps	243.8	F	24.0 (SE) 15.8 (NE)	C B	2098.1	F	29.7 (SE) 27.8 (NE)	C C
Technology Blvd	275.2	F	34.6	C	1985.4	F	81.5	F
Williamson Blvd	269.8	F	118.7	F	2239.9	F	130.2	F
Concierge Blvd*	4942.7	F	57.2	F	9924.1	F	616.3	F
Clyde Morris Blvd	407.4	F	53.2	D	2029.3	F	217.9	F

\*Worst movement delay reported (stop control intersection)

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Table 21. Ramp Terminal Queues – Design Year 2050

I-95 Ramp Terminal	Mvm nt	Design Year 2050					
		No-Build			Build		
		Avg Queue AM (PM)	Max Queue AM (PM)	Storage* Turn Bay / Off-Ramp	Avg Queue AM (PM)	Max Queue AM (PM)	Storage* Turn Bay / Off-Ramp
SB Ramp Terminal	EBT	19 (2)	308 (157)	-	46 (179)	444 (659)	-
	EBR	- (-)	- (-)	<b>500'</b>	25 (22)	295 (176)	<b>1,200'</b>
	WBL	- (-)	- (-)	<b>675'</b>	79 (71)	424 (441)	<b>675'</b>
	WBT	1318 (1415)	1,487 (1,480)	-	79 (71)	424 (441)	-
	SBL	<b>4,115 (4,114)</b>	<b>4,168 (4,168)</b>	<b>2,500'</b>	98 (39)	434 (260)	<b>650' / 3,325'</b>
	SBR	<b>4,168 (4,168)</b>	<b>4,222 (4,222)</b>	<b>300' / 2,500'</b>	70 (63)	323 (265)	<b>725' / 2,625'</b>
NB Ramp Terminal	EBL	- (-)	- (-)	<b>775'</b>	41 (94)	279 (508)	<b>1,000'</b>
	EBT	28 (12)	362 (195)	-	267 (134)	1086 (795)	-
	WBT	899 (1,194)	1,290 (1,268)	-	143 (228)	797 (966)	-
	WBR	- (-)	- (-)	<b>300'</b>	29 (194)	346 (901)	<b>1,400'</b>
	NBL	<b>2,163 (4,698)</b>	<b>4,661 (4,750)</b>	<b>800' / 2,775'</b>	51 (106)	278 (502)	<b>800' / 3,500'</b>
	NBR	<b>2,167 (4,231)</b>	<b>4,665 (4,297)</b>	<b>625' / 2,775'</b>	100 (132)	477 (895)	<b>825' / 3,125'</b>
SB Ramp Signal	I-95	- (-)	- (-)	-	255 (52)	1013 (566)	<b>1,500'</b>

\*Turn bays measured from stop bar to end of taper; Off-ramps measured from stop bar to gore point

The Design Year 2050 movement evaluation showed that some side streets experience LOS F. These locations are not state-maintained and typically have existing or planned developments. Notable side-street movements with LOS F operations and queues over 1,000-feet in either peak hour, shown in **Appendix K**, are:

- Tournament Drive eastbound left – existing development configuration
- Tymber Creek southbound – existing development configuration with additional left-turn
- Champions Drive northbound and southbound – existing development configuration
- Tomoka Farms Road northbound and southbound – existing roadway configuration
- Outlet Boulevard northbound and southbound – approach maximized within existing pavement
- Williamson Boulevard northbound and southbound – existing roadway configuration
- Clyde Morris Boulevard northbound and southbound – outside PD&E limits

## 7.0 Safety Analysis

A safety analysis was conducted for the future conditions of LPGA Boulevard from Tournament Drive to Clyde Morris Boulevard and includes the I-95 interchange area. This section summarizes the results. The full safety report is provided in **Appendix H**. The safety predictive methods utilized in this evaluation were based on the Safety Performance Functions (SPFs) provided in the HSM predictive methods Part C to forecast or predict the crash frequency for the Build and No-Build Alternatives. The HSM Enhanced Interchange Safety Analysis Tool (ISATe) was used for the safety analysis of the I-95 interchange at LPGA Boulevard to predict crash frequency and severity and according to roadway geometry, intersection geometry, and traffic conditions. Predicted crash frequency for the LPGA Boulevard arterial segments and intersections was forecasted using the FDOT HSM spreadsheet tools available on the FDOT website. The ISATe and the FDOT HSM spreadsheets used to calculate the anticipated future crash frequencies are provided in the safety report in **Appendix H**.

### 7.1 Interchange Predicted Crashes

The HSM ISATe spreadsheet tool was utilized in the predictive method safety analysis for the I-95 interchange area at LPGA Boulevard. The interchange facility component segmentation (freeway and ramps) is provided in the safety report. The analysis did not include the ramp terminals due to the limitation of the HSM and ISATe methods in predicting crashes at the signalized turbine interchange ramp terminals, which include one-way traffic flow on LPGA Boulevard through the interchange area. The Crash Modification Factor (CMF) clearinghouse developed by the FHWA also does not provide CMFs for this unique signalized turbine interchange configuration. Safety benefits of the ramp terminals is discussed qualitatively:

- Elimination of two-way traffic conflicts, including the reduction in many potential conflicts at intersections in a two-way system
- Simplification of intersection traffic control signal phases (two phase signal)
- Reduction of crosswalk lengths and wait times for pedestrians at ramp terminals
- Free-flow right-turn movements from LPGA Boulevard onto I-95 on ramps are eliminated in the Build Alternative increasing safety for bicyclist and pedestrians

The overall cumulative predicted crashes are summarized in **Table 22** by facility component and crash severity for the analysis period (from 2030 to 2050).

In the Build Alternative the forecasted crashes for the analysis period show a decrease of 12,086 crashes or 29.5% for freeway segments over the analysis period. A decrease in freeway segments crashes for the Build Alternative freeway segments could be attributed to the reduction of ramp entrances and exits along the freeway segments in the Build condition as the result of removing speed change areas associated with the new interchange configuration. The interchange ramp segments are longer in the Build Alternative and the additional ramp lengths could be contributing to the additional predicted crashes in the Build scenario for this facility component.

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Table 22. I-95 at LPGA Boulevard Interchange Predicted Crashes by Facility (2030 – 2050)

	Facility Component	Total	K	A	B	C	PDO
<b>No-Build</b>	Freeway Segments	41,004.5	173.5	446.4	3,122.9	6,207.8	31,053.9
	Ramp Segments	195.6	2.4	7.3	35.0	42.8	108.0
<b>Build</b>	Freeway Segments	28,918.6	122.4	315.0	2,203.4	4,380.0	21,897.8
	Ramp Segments	195.3	2.1	6.5	30.9	41.1	114.7
<b>Difference</b> (= Build - No Build)	Freeway Segments	-12,085.9	-51.1	-131.4	-919.5	-1,827.8	-9,156.1
	Ramp Segments	-0.3	-0.3	-0.8	-4.1	-1.7	6.7

Note: fatality (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C), property damage only (PDO).

The cumulative overall predicted crashes for the freeway and ramp segments for the interchange area in the No-Build and Build scenarios for the analysis period (2030 to 2050) is summarized in **Table 23**. The cumulative overall predicted crashes did not include the ramp terminal crashes in the No-Build Alternative. Overall, the Build scenario is predicted to reduce crashes by 12,086 or 29.3% over the analysis period.

Table 23. I-95 at LPGA Boulevard Interchange Overall Predicted Crashes (2030 – 2050)

	Measure	Total	K	A	B	C	PDO
<b>No-Build</b>	Overall	41,200.1	175.9	453.7	3,157.9	6,250.6	31,161.9
	Average/Year	1,961.9	8.4	21.6	150.4	297.6	1,483.9
<b>Build</b>	Overall	29,113.9	124.6	321.5	2,234.3	4,421.1	22,012.5
	Average/Year	1,386.4	5.9	15.3	106.4	210.5	1,048.2
<b>Difference</b> (= Build - No Build)	Overall	-12,086.2	-51.3	-132.2	-923.6	-1,829.5	-9,149.4
	Average/Year	-575.5	-2.5	-6.3	-44.0	-87.1	-435.7

Note: fatality (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C), property damage only (PDO).

## 7.2 Arterial Predicted Crashes

The HSM predictive crash analysis was conducted for the arterial segments and intersections within the AOI.

**Table 24** summarizes the predicted average crashes per year for the No-Build and Build Alternatives. In Opening Year 2030, the No-Build Alternative would result in a total number of 111.6 crashes per year and the Build Alternative forecasts 71.5 crashes per year, which is a reduction of 40.1 future crashes (or 36%) for the arterial segments and intersections. In Design Year 2050, the No-Build Alternative would result in a total number of 182.7 crashes per year and the Build Alternative forecasts 113.5 crashes per year, which is a reduction of 69.2 future crashes (or 38%) for the arterial segments and intersections.

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Table 24. LPGA Boulevard Predicted Crash Comparison for Design Year 2050

Crash Severity	LPGA Blvd Predicted Crashes (crashes/year)					
	Opening Year 2030			Design Year 2050		
	No-Build	Build	Difference <sup>1</sup>	No-Build	Build	Difference <sup>1</sup>
<b>Total Crashes</b>	111.6	71.5	-40.1	182.7	113.5	-69.2
<b>Fatal and injury (FI)</b>	41.6	30.8	-10.8	67.8	48.8	-19.0
<b>Property damage only (PDO)</b>	70.1	40.8	-29.3	115.0	64.8	-50.2

<sup>1</sup> Difference = Build – No-Build

### 7.3 Crash Cost Comparison

The average cost per crash and the crash distribution factors for roadway facility types were obtained from the 2022 Florida Design Manual (FDM) Section 122.6. The predictive crash cost comparison completed for the No-Build and Build Alternatives is divided into two costs; the arterial LPGA Boulevard segments and intersections east and west of the I-95 interchange, and I-95 interchange area (including mainline freeway segments). A cumulative predicted crash cost comparison is shown in **Table 25**. Due to limitations of the ISATe spreadsheet tool, predicted costs for crashes occurring at the ramp terminal intersections were not included. The Build Alternative is forecasted to incur a lesser crash cost by approximately \$1.6 billion compared to the No-Build Alternative for the analysis period.

Table 25. Predicted Total Crash Cost Overall Comparison (2030 – 2050)

	Cumulative Predicted Costs (crashes/year)		
	No-Build	Build	Difference (= Build – No Build)
<b>Interchange Area</b>	\$4,001,657,446.78	\$2,829,584,456.06	-\$1,172,072,990.72
<b>Arterial segments</b>	\$740,618,942.44	\$344,807,289.27	-\$395,811,653.17
<b>Total</b>	\$4,742,276,389.22	\$3,174,391,745.33	-\$1,567,884,643.89

## 8.0 Recommended Alternative

Based on the safety and operational analysis of the study area performed and summarized in this document, the Build Alternative will perform better than the No-Build Alternative. The Build Alternative includes a signalized turbine interchange, widening LPGA Boulevard, replacing Tomoka River bridge, and improving intersections.

The traffic operational analysis shows that the No-Build Alternative cannot accommodate the future traffic demand in Opening Year 2030 or Design Year 2050. The No-Build Alternative is severely congested due to travel demand to use LPGA Boulevard and the I-95 ramps being substantially above the capacity of the existing facilities. The two-lane section west of I-95 gridlocks the entire network, including the I-95 mainline. The recommended Build Alternative alleviates the congestion by expanding roadway capacity and increasing the efficiency of the interchange. The Build Alternative uses a series of two-phase signals to reduce delay at the I-95 interchange. Additionally, it uses a combination of left-hand and right-hand exits to the I-95 to allow for more even lane utilization on LPGA Boulevard through the interchange area resulting in better levels of service (LOS C or better).

In the Design Year 2050, the Build Alternative improves the total network delay by 77% in the AM peak hour and 78% in the PM peak hour compared to the No-Build Alternative. While the Design Year 2050 shows deficiencies (in speeds) on I-95 southbound from the I-95/LPGA interchange to the US/I-4 92 CD system diverge area, the Build Alternative still provides significant benefit over the No-Build. District 5 is in the process of conducting a strategic plan for I-95 to develop a long-term shared vision with the members of the communities and local stakeholders along the corridor. The I-95 strategic plan will identify improvements which will address congestion and safety in this area and are planned to be implemented by 2050.

The safety analysis shows the improvements proposed in the Build Alternative enhance the overall safety of the I-95 interchange area, the arterial segments, and intersections. For the interchange area in the Build Alternative, the predicted total crashes and fatal crashes are approximately 29% lower than the No-Build Alternative. The total crashes on LPGA Boulevard are also expected to be lower in the Build Alternative by 36% in Design Year 2050 and by 38% in Opening Year 2030. Finally, the crash cost comparison shows the Build Alternative is forecasted to incur a lesser predicted crash cost by approximately \$1.6 billion than the No-Build Alternative over the 2030 to 2050 analysis period.

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## 9.0 Other Considerations

### 9.1 Consistency with Other Plans and Funding Plan

Improvements to LPGA Boulevard and I-95 interchange are consistent with the R2CTPO Connect 2045 LRTP and Fiscal Year (FY) 2020/2021 to FY 2024/2025 TIP.

The PD&E and Design phases of this project were funded for FY 2021/2022. Right of way phase is partially funded for FY 2026/2027. Construction phase is not currently funded. **Table 26** summarizes the funding status from the FDOT Work Program for this project.

*Table 26. FDOT Five Year Work Program Funding*

Phase	Funding	Amount
<b>PD&amp;E Study</b>	Ongoing: Completion Fall 2023	\$3.7 Million
<b>Design*</b>	Funded: Spring 2022	\$7 Million
<b>Right-of-Way**</b>	Partially Funded: 2027	\$7 Million
<b>Construction</b>	Unfunded	-

*\*Design is being conducted concurrently with the PD&E Study*

*\*\*All proposed improvements are expected to be within the existing right of way except stormwater management ponds between Tomoka Farms Road and Tymber Creek Road. Actual cost of stormwater management ponds will be determined at the Conclusion of PD&E Study.*

The R2CTPO Connect 2045 LRTP lists LPGA Boulevard as a SIS Cost Feasible Project, shown in **Table 27**.

*Table 27. River to Sea TPO Connect 2045 – SIS Cost Feasible Projects*

Facility	Improvement	Cost (Year of Expenditure)
<b>I-95/LPGA Boulevard Interchange from Williamson Boulevard to US 92</b>	Interchange Improvement	\$32.48 Million
<b>Tomoka River Bridge (LPGA Boulevard) from West of Champions Drive to East of Tomoka Farms Road</b>	Bridge to match interchange configuration	Funded*

*\* Included in the I-95/LPGA Boulevard Interchange project from Williamson Blvd to US 92*

### 9.2 Environmental Considerations

This IMR is being developed concurrently with the PD&E study. Details regarding the potential for the proposed project to impact the social, cultural, natural, and physical environmental resources will be documented in the Environmental Report. Proposed roadway improvements (with the exception of stormwater ponds) are expected to occur within the existing right-of-way.

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### 9.3 Project Schedule

The PD&E Study for the LPGA Boulevard is currently in progress. A Public Hearing is scheduled in August 2023. The design for LPGA Boulevard is being performed concurrently with the PD&E Study.

### 9.4 Conceptual Signing Plan

Conceptual signing and marking plans in accordance with FHWA and the Manual on Uniform Traffic Control Devices (MUTCD) guidelines were prepared for the Build Alternative and are provided in **Appendix C**. The purpose of the signing plans is to demonstrate their ability to provide adequate advanced signing and directions to drivers entering or exiting the interchange area, specifically as it relates to non-traditional intersection and interchange configurations.

### 9.5 Access Management

The existing and proposed Access Classes are in **Table 28**. I-95 is a limited access facility designated as Access Class 1. LPGA Boulevard is currently a county-maintained roadway and most closely resembles Access Classes 3 and 4. On LPGA Boulevard, west of Tomoka Farms Road, there is a proposed change from Access Class 4 (non-restrictive median type) to Access Class 3 (restrictive median type).

*Table 28. Access Classifications*

LPGA Segment	Access Class	
	Existing / No-Build	Proposed / Build
I-95	Access Class 1	Access Class 1
Tournament Dr to Tomoka Farms Rd	Access Class 4 (Non-Restrictive Median Type)	Access Class 3 (Restrictive Median Type)
Tomoka Farms Rd to Williamson Blvd	Access Class 3 (Restrictive Median Type)	Access Class 3 (Restrictive Median Type)

**Table 29** summarized existing median openings within the AOI. From Tomoka Farms Road to Clyde Morris Boulevard has five existing median openings located at the I-95 ramp terminal intersections, Technology Boulevard/Outlet Boulevard and Williamson Boulevard. The minimum median opening spacing and signal spacing standards of 2,640 feet is not met throughout this segment.

**Table 30** summarizes proposed median openings as the result of proposed roadway and interchange improvements. On I-95, no new interchanges are proposed in the Build Alternative.

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Table 29. Existing Median Opening from Tournament Drive to Clyde Morris Boulevard

Location	Posted Speed	Access Class/Type	Intersecting Street/Development	Signal (Y or N)	Distance from Previous Opening (ft.)
Sta. 584+79.87	45	3 Signal	I95 Southbound Exit Ramp	Y	659.05
Sta. 599+33.73	45	3 Signal	I95 Northbound Exit Ramp	Y	1397.76
Sta. 611+57.19	45	3 Signal	Outlet Blvd	Y	1124.45
Sta. 624+29.70	45	3 Signal	Williamson Blvd	Y	1105.84
Sta. 632+13.38	45	3 Full	Concierge Blvd	N	678.68

Table 30. Proposed Median Opening from Tournament Drive to Clyde Morris Boulevard

Location	Posted Speed	Type	Intersecting Street/Development	Signal (Y or N)	Distance from Previous Opening (ft.)
516+78.51	45	3 Signal	Tournament Dr	Y	1954.2
535+99.08	35	3 Signal	Tymber Creek Rd	Y	1748.59
555+51.29	35	3 Signal	Fire Station # 7	Y	1805.79
562+68.83	35	3 Signal	Champions Dr	Y	584.27
573+93.64	35	3 Signal	Tomoka Farms Rd	Y	994.63
586+96.84	35	3 Directional	I95 SB Ramps	N	1217.48
595+42.12	35	3 Directional	I95 NB Ramps	N	828.78
611+73.81	35	3 Signal	Outlet Blvd	Y	1514.39
624+29.73	35	3 Signal	Williamson Blvd	Y	1106.17

On LPGA Boulevard, the Build Alternative includes the following access modifications:

- West of Tomoka Farms Road, the Access Class for LPGA Boulevard will change from Access Class 4 since the roadway will be widened from 2-lane 2-way to 6-lane divided median. From Tomoka Farms Road to Williamson Boulevard, the Access Class 3 designation will not change.
- From Tournament Drive to Tomoka Farms Road the number of median openings will go from zero (0) to four (4). The proposed median openings and their locations are as follows:
  - Located at Tymber Creek Road (signalized intersection)
  - Located at Dayton Beach Fire Station #7 (emergency signal intersection)
  - Located at Champions Drive (signalized intersection)
  - Located at Tomoka Farms Road (signalized intersection)

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- LPGA Boulevard at Concierge Boulevard (unsignalized) currently has a median opening and is located approximately 750-feet east of the adjacent signalized intersection at Williamson Boulevard. The proposed design closes this median to accommodate westbound widening on LPGA Boulevard and westbound turn-lane improvements at Williamson Boulevard. Closing of this median will improve operations and safety as the queue from the westbound left turn vehicles may interfere with the vehicles that would cross median. The restricted movements are rerouted to the adjacent intersections at Williamson Boulevard and Clyde Morris Boulevard.

## 10.0 Conclusion and Recommendations

This IMR documents the safety and operational impacts of the proposed I-95 at LPGA Boulevard interchange improvement. The report summarizes existing conditions, traffic forecasting, future conditions, and recommendations for Opening Year 2030 and Design Year 2050.

The Build Alternative (which consists of roadway widening, intersection improvements and redesign of I-95 interchange to a signalized turbine interchange concept) is the recommended alternative based on the analysis results and ability to address the project purpose and need.

The Build Alternative addresses the two FHWA policy points. The LPGA Boulevard signalized turbine interchange and associated arterial widening does not have an adverse impact on I-95 or the local network based on future traffic projections. The Build Alternative provides full access to I-95.

### Operational Analysis Results

This IMR addresses the existing interchange at LPGA Boulevard that is planned to be modified. Detailed traffic operational analyses for the Existing Year 2021, Opening Year 2030, Design Year 2050 conditions were conducted to study the impacts of the Build Alternative within the area of influence.

The following operational analysis observations were made:

- **Networkwide** – The No-Build Alternative cannot accommodate the future traffic growth, in either Design Year 2050 or Opening Year 2030, and results in gridlock conditions along LPGA Boulevard. The primary causes are the single-lane interchange exit ramps and the two-lane section of LPGA Boulevard west of I-95, which are considerably over capacity. Additionally, roadway segments and intersections do not have sufficient capacity to project future demand. In the Design Year 2050, the Build Alternative improves the total network delay by 77% in the AM peak hour and 78% in the PM peak hour compared to the No-Build Alternative. By Design Year 2050, latent demand increases when compared to the Opening Year 2030 due to congestion formed at the US 92/I-4 collector-distributor (CD) system and minor streets. The amount of latent demand is however significantly very low when compared to No-Build Condition. The results of operational analysis showed that the Build Alternative still provides significant benefit of reducing latent demand by 83% in the AM peak hour and 94% in the PM peak hour when compared to the No-Build Alternative. Additionally, the interchange improvements and roadway widening in the Build Alternative cause the networkwide average speeds increase significantly from 11 mph to 37 mph in the AM peak hour and from 1 mph to 28 mph in the PM peak hour.
- **Freeway** – The microsimulation analysis results indicate that in both directions and peaks, the No-Build Design Year 2050 travel traffic flow is near standstill due to the ramp terminal intersections queuing back to the mainline and blocking through traffic. This also results in lower volume processed through I-95 since demand cannot reach the

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interchange area. Consequently, due to demand starvation (metering of demand upstream due to bottlenecks), the speeds in some segments (downstream of metered area) are higher and the throughput is low because of the queue discharge flow. Conversely, in the Build Alternative Design Year 2050, the bottlenecks (grid lock conditions) observed under No-Build Alternative are cleared. Therefore, the throughput (vehicle volumes) increases, and the travel speeds return to near free-flow speeds under Build conditions. This is due to the improved LPGA Boulevard interchange, which includes two-lane entrance and exit ramps. However, the I-95 southbound section, between LPGA Boulevard and the US 92/I-4 CD system, is expected to operate at capacity (LOS E) between 2045 and 2050 which will cause the speed to drop below 45 mph. Typically, when a segment is operating at near capacity, any slight increase of demand (caused by normal demand fluctuation) can trigger the breakdown. To minimize the recurrence of freeway breakdown in the US 92/I-4 CD system diverge area, ramp signals were added into the southbound on-ramp and the number of lanes at the entrance was reduced to one to further manage the demand from LPGA Boulevard into I-95 southbound lanes. This modification seems to extend the operational life of the diverge area to 2045. It is noted that the US 92/I-4 CD system diverge area is outside the limits of improvements for this PD&E. FDOT District 5 is aware of the operational issue at the US 92/I-4 CD system and is embarking on a strategic plan for I-95 to develop a long-term shared vision with the members of the communities and local stakeholders along the corridor. The I-95 strategic plan will identify short-term and long-term capacity, operational and safety improvements along the corridor. It is likely the recommendations from the strategic plan for US 92/I-4 CD system will be implemented by 2050. In the interim, a ramp signal at the southbound on-ramp has been evaluated. FDOT is also evaluating additional Transportation Systems Management and Operations (TSMO) strategies in the interim to extend the operational life of I-95 south of LPGA Boulevard as part of the design phase for this project.

- **Ramp Terminals** – The LOS target for ramp terminals is LOS D. Intersection LOS F is expected in the No-Build by 2030, and delays will significantly increase by the Design Year 2050. Conversely, all ramp terminal intersections under Build Alternative conditions are expected to operate at LOS C or better in the Design Year 2050.
- **Arterial Intersections** – The LOS target for arterial intersections is LOS E. The No-Build Alternative is expected to operate at LOS F in the Opening Year 2030 and Design Year 2050 with excessive intersection delays and long queues. Proposed improvements in the Build Alternative are expected to significantly reduce intersection delays and queues at all intersections. It is noted that in the Design Year 2050 Build Alternative, LOS F is expected at Tymber Creek Road, Tomoka Farms Road, Technology Boulevard, and Concierge Boulevard due to capacity limitations of minor street improvements (which are outside of the scope of this PD&E). Both the City of Daytona Beach and Volusia County are aware of the need for network expansion and are looking at several roadway improvements in the local network in response to the current and projected growth in the

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LPGA Boulevard subarea. However, these improvements are not currently programmed in the local government comprehensive plans. In recognizing the need for future capacity, LPGA Boulevard and I-95 ramps have been sized with number of lanes enough to serve the latent demand from adjacent crossing streets. It is noted that Tomoka Farms Road, and Technology Boulevard intersections are located adjacent to the I-95 ramp terminals. Although the minor street delay drives up overall intersection delay, it is not expected to adversely impact I-95 ramp terminal operations.

- **Overall** – The proposed Build Alternative provides a benefit to the network and does not adversely impact operations.

### Safety Analysis Results

A safety analysis was conducted for the future conditions on LPGA Boulevard from Tournament Drive to Clyde Morris Boulevard, including the I-95 interchange area. The following findings were obtained from the safety analysis:

- **I-95 Interchange** – Overall crashes per year, including fatalities and injuries, are expected to decrease by approximately 29% in the Build Alternative over the analysis period (from 2030 through 2050). In the Build Alternative, the forecasted total number of crashes for the analysis period show a substantial decrease for freeway segments and slight decrease for ramp segments. The decrease in freeway segment crashes for the Build alternative could be attributed to the reduction of ramp entrances and exits along the freeway segments in the Build condition. It is noted that although the total number of crashes for ramp segments is expected to decrease, the property-damage-only crashes are expected to slightly increase; fatalities and injuries are expected to slightly decrease. The interchange ramp segments are longer in the Build Alternative and the additional ramp lengths could be contributing to the additional predicted crashes in the Build Alternative for this facility component.
- **LPGA Boulevard Arterial** – In Design Year 2050, the No-Build Alternative would result in a total number of 182.7 crashes per year and the Build Alternative forecasts 113.5 crashes per year, which is a reduction of 69.2 future crashes (or 38%) for the arterial segments and intersections. Reduction in expected crashes is the result of proposed improvements at the intersections and widening of the LPGA Boulevard corridor.
- **Crash Cost Comparison** – The Build Alternative is forecasted to incur a lesser predicted crash cost by approximately \$1.6 billion than the No-Build Alternative for the 2030 to 2050 analysis period.

### Conceptual Signing Plan

Conceptual signing plans were developed per the MUTCD guidelines and are included in **Appendix C**.

# **Appendix A**

## Methodology Letter of Understanding (MLOU)

# Appendix B

## Phase 1 Analysis Memo

# Appendix C

## Conceptual Signing Plan

# Appendix D

## Project Traffic Forecasting Memorandum

# Appendix E

## Calibration Report

# Appendix F

## Traffic Count Data

## **Appendix G**

### **Raw Data (OD Matrix, Signal Timing, Travel Speeds, Travel Time)**

# Appendix H

## Safety Report

# Appendix I

## Existing Year 2021 Detailed Movement Results

# Appendix J

## Design Year 2030 Detailed Movement Results

# Appendix K

## Opening Year 2050 Detailed Movement Results



## Florida Department of Transportation District 5

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